THE

ENCYCLOPÆDIA BRITANNICA

ELEVENTH EDITION

SECOND	,,	,,	ten	,, 1777—1784.
THIRD	,,	,,	eighteen	,, 1788—1797.
FOURTH	,,	,,	twenty	,, 1801—1810.
FIFTH	,,	,,	twenty	,, 1815—1817.
SIXTH	,,	,,	twenty	,, 1823—1824.
SEVENTH	,,	,,	twenty-one	,, 1830—1842.
EIGHTH	,,	,,	twenty-two	,, 1853—1860.
NINTH	,,	,,	twenty-five	,, 1875—1889.
TENTH	,,	ninth edition and eleven supplementary volumes,		1902—1903.
ELEVENTH	,,	published in twenty-nine volumes,		1910—1911.

THE

ENCYCLOPÆDIA BRITANNICA

A

DICTIONARY

OF

ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION

ELEVENTH EDITION

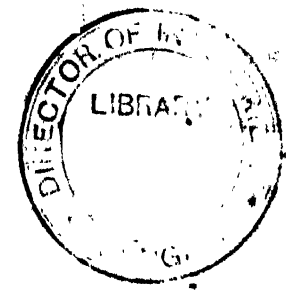
VOLUME VIII

DEMIJOHN to EDWARD

Cambridge:
at the University Press
1910

CAMBRIDGE UNIVERSITY PRESS
FETTER LANE, LONDON, E.C.
C. F. CLAY, MANAGER
Edinburgh: 100, Princes Street

Germany	Leipzig:	F. A. Brockhaus, Querstrasse, 16.
Italy	Milan:	Ulrico Hoepli, Galleria di Cristoforis, 59-63.
Holland	Amsterdam:	J. G. Robbers, N.Z. Voorburgwal, 64.



INITIALS USED IN VOLUME VIII. TO IDENTIFY INDIVIDUAL CONTRIBUTORS,[1] WITH THE HEADINGS OF THE ARTICLES IN THIS VOLUME SO SIGNED.

A. Ca.	ARTHUR CAYLEY, LL.D., F.R.S. See the biographical article: CAYLEY, ARTHUR.	**Determinant.**
A. E. G.*	REV. ALFRED ERNEST GARVIE, M.A., D.D. Principal of New College, Hampstead. Member of the Board of Theology and Board of Philosophy, London University. Formerly Professor of Philosophy, Theism, Comparative Religion, and Christian Ethics in Hackney and New Colleges, London. Author of *Studies in the Inner Life of Jesus*; *The Christian Certainty*; &c.	**Devil.**
A. E. S.	ARTHUR EVERETT SHIPLEY, M.A., D.Sc., F.R.S., F.Z.S., F.L.S. Fellow, Tutor and Lecturer of Christ's College, Cambridge. University Reader in Zoology. President of the Association of Economic Biologists. Formerly University Lecturer on the Advanced Morphology of the Invertebrata. Author of *Zoology of the Invertebrata*. Editor of the Pitt Press *Natural Science Manuals*; &c.	**Desmoscolecida; Echiuroidea.**
A. Fl.	PIERRE MARIE AUGUSTE FILON. See the biographical article: FILON, P. M. A.	**Drama: *French* (*in part*).**
A. F. P.	ALBERT FREDERICK POLLARD, M.A., F.R.HIST.SOC. Fellow of All Souls' College, Oxford. Professor of English History in the University of London. Assistant Editor of the *Dictionary of National Biography*, 1893-1901. Author of *England under the Protector Somerset*; *Life of Thomas Cranmer*; &c.	**Edward VI.**
A. G.	MAJOR ARTHUR GEORGE FREDERICK GRIFFITHS (d. 1908). H.M. Inspector of Prisons, 1878-1896. Author of *The Chronicles of Newgate*; *Secrets of the Prison House*; &c.	**Deportation.**
A. G. D	ARTHUR GEORGE DOUGHTY, C.M.G., M.A., LITT.D., F.R.HIST.S. Dominion Archivist of Canada. Member of the Geographical Board of Canada. Author of *The Cradle of New France*; &c. Joint Editor of *Documents relating to the Constitutional History of Canada.*	**Dorion.**
A. H. J. G.	ABEL HENDY JONES GREENIDGE, M.A., D.LITT. (d. 1905). Formerly Fellow and Lecturer of Hertford College, Oxford, and of St John's College, Oxford. Author of *Infamia in Roman Law*; *Handbook of Greek Constitutional History*; *Roman Public Life*; *History of Rome.* Joint Editor of *Sources of Roman History, 133-70 B.C.*	**Dictator.**
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A. J. P.	ALEXANDER J. PHILIP. Borough Librarian of Gravesend.	**Dene-holes.**
A. L. G.	ANDREW LOCKHART GILLESPIE, M.D., F.R.S. (Edin.) (d. 1904). Formerly Lecturer on Modern Gastric Methods, Edinburgh Post-Graduate School. Author of *Manual of Modern Gastric Methods*; &c.	**Digestive Organs: *Pathology* (*in part*).**
A. Mw.	ALLEN MAWER, M.A. Professor of English Language and Literature, Armstrong College, Newcastle-on-Tyne. Fellow of Gonville and Caius College, Cambridge. Formerly Lecturer in English at the University of Sheffield.	**Denmark: *Ancient History*; Edgar, King; Edmund, King of East Anglia; Edmund I.; Edred; Edward (the Elder); Edward (the Martyr).**
A. M. C.	AGNES MARY CLERKE. See the biographical article: CLERKE, A. M.	**Dick, Thomas; Donati.**
A. N.	ALFRED NEWTON, F.R.S. See the biographical article: NEWTON, ALFRED.	**Diver; Dodo** (*in part*); **Dove; Duck; Eagle.**

[1] A complete list, showing all individual contributors, with the articles so signed, appears in the final volume.

A. R. C.	ALEXANDER ROSS CLARKE, C.B., F.R.S. Colonel, R.E. Royal Medal of Royal Society, 1887. In charge of Trigonometrical Operations of the Ordnance Survey, 1854–1881.	**Earth, Figure of the** (*in part*).
A. S. Wo.	ARTHUR SMITH WOODWARD, LL.D., F.R.S. Keeper of Geology, Natural History Museum, South Kensington. Secretary of the Geological Society, London.	**Diplodocus.**
A. Wa.	ARTHUR WAUGH, M.A. New College, Oxford. Newdigate Prize, 1888. Managing Director of Chapman & Hall, Ltd. Author of *Gordon in Africa*; *Alfred, Lord Tennyson*. Editor of Johnson's *Lives of the Poets*; editions of *Dickens, Tennyson, Arnold, Lamb*; &c.	**De Tabley.**
A. W. H.*	ARTHUR WILLIAM HOLLAND. Formerly Scholar of St John's College, Oxford. Bacon Scholar of Gray's Inn, 1900.	**Derby, Earls of** (*in part*).
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C. Ch.	CHARLES CHREE, M.A., LL.D., D.Sc., F.R.S. Superintendent, Kew Observatory. Formerly Fellow of King's College, Cambridge. President of Physical Society of London. Watt Medallist, Institute of Civil Engineers, 1905	**Earth Currents.**
C. C. H.	CHARLES CAESAR HAWKINS, M.A., M.I.E.E. Author of *The Dynamo*.	**Dynamo.**
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C. F. A.	CHARLES FRANCIS ATKINSON. Formerly Scholar of Queen's College, Oxford. Captain, 1st City of London (Royal Fusiliers). Author of *The Wilderness and Cold Harbour*.	**Dutch Wars**: *Military*.
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C. R. B.	CHARLES RAYMOND BEAZLEY, M.A., D.LITT., F.R.G.S., F.R.HIST.S. Professor of Modern History in the University of Birmingham. Formerly Fellow of Merton College, Oxford, and University Lecturer in the History of Geography. Lothian Prizeman, Oxford, 1889. Lowell Lecturer, Boston, 1908. Author of *Henry the Navigator*; *The Dawn of Modern Geography*; &c.	**Diaz de Novaes**; **Dicuil.**
C. S. P.*	REV. CHARLES STANLEY PHILLIPS. King's College, Cambridge. Gladstone Memorial Prize, 1904.	**Edmund Ironside**; **Edward the Confessor.**
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D. H.	DAVID HANNAY. Formerly British Vice-Consul at Barcelona. Author of *Short History of Royal Navy, 1217–1688*; *Life of Emilio Castelar*; &c.	**Dudley, Sir Robert**; **Dutch Wars**: *Naval*.
D. Mn.	REV. DUGALD MACFADYEN, M.A. Minister of South Grove Congregational Church, Highgate. Director of the London Missionary Society.	**Duff, Alexander.**

E. A. T.	MRS (ETHEL) ALEC TWEEDIE. Author of *Porfirio Diaz*; *Mexico as I saw it*; &c.	**Diaz, Porfirio.**
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E. C. B.*	EDWARD CRESSWELL BABER, M.A. (d. 1910). Formerly Senior Surgeon, Brighton and Sussex Throat and Ear Hospital. Prizeman and William Brown Scholar, St George's Hospital, London. Author of numerous papers on Diseases of the Ear, Nose and Throat.	**Ear**: *Diseases.*
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E. G.	EDMUND GOSSE, LL.D. See the biographical article: GOSSE, EDMUND.	**Denmark**: *Literature*; **Descriptive Poetry; Dialogue; Diary; Didactic Poetry; Dithyrambic Poetry; Donne; Drachmann; Drayton, Michael; Dutch Literature; Edda.**
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E. O'M.	REV. EUGENE HENRY O'MEARA, M.A. Vicar of Tallaght, County Dublin.	**Diatomaceae** (*in part*).
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F. A. B.	FRANCIS ARTHUR BATHER, M.A., D.Sc., F.R.S., F.R.G.S. Assistant Keeper of Geology, British Museum. Rolleston Prizeman, Oxford, 1892. Author of "Echinoderma" in *A Treatise on Zoology*; *Triassic Echinoderms of Bakony*; &c.	**Echinoderma.**
F. E. B.	FRANK EVERS BEDDARD, M.A., F.R.S. Prosector of the Zoological Society, London. Formerly Lecturer in Biology at Guy's Hospital. Naturalist to "Challenger" Expedition Commission, 1882-1884. Author of *Text-Book of Zoogeography*; *Animal Colouration*; &c.	**Earth-worm.**
F. G. M. B.	FREDERICK GEORGE MEESON BECK, M.A. Fellow and Lecturer in Classics, Clare College, Cambridge.	**East Anglia.**

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F. G. P.*	FRANK GEORGE POPE. Lecturer on Chemistry, East London College (University of London).	**Diazo Compounds.**
F. J. H.	FRANCIS JOHN HAVERFIELD, M.A., LL.D., F.S.A. Camden Professor of Ancient History in the University of Oxford. Fellow of Brasenose College. Fellow of the British Academy. Author of Monographs on Roman History, especially Roman Britain, &c.	**Eburācum.**
F. Ll. G.	FRANCIS LLEWELYN GRIFFITH, M.A., PH.D., F.S.A. Reader in Egyptology, Oxford University. Formerly Scholar of Queen's College, Oxford. Editor of the *Archaeological Survey* and *Archaeological Reports* of the Egypt Exploration Fund. Fellow of Imperial German Archaeological Institute.	**Dendera; Edfu.**
F. R. H.	FREDERICK ROBERT HELMERT, PH.D., D.ING. Professor of Geodesy, University of Berlin.	**Earth, Figure of the.**
F. R. M.	FRANCIS RICHARD MAUNSELL, C.M.G. Lieutenant-Colonel. Military Vice-Consul, Sivas, Trebizond, Van (Kurdistan), 1897–1898. Military Attaché, British Embassy, Constantinople, 1901–1905. Author of *Central Kurdistan*; &c.	**Diarbekr** (*in part*).
F. S.	FRANCIS STORR, M.A. Editor of the *Journal of Education*, London. Officier d'Académie, Paris.	**Duel.**
F. T. M.	SIR FRANK THOMAS MARZIALS, K.C.B. Formerly Accountant General of the Army. Editor of the "Great Writers" Series.	**Dumas: *fils.***
F. V. T.	FREDERICK VINCENT THEOBALD, M.A. Vice-Principal and Zoologist, S.E. Agricultural College, Wye, Kent (University of London). Grand Medallist of the Société Nationale d'Acclimatation de France. Author of *The Insect and other Allied Pests of Orchard, Bush and Hothouse Fruits*; &c.	**Economic Entomology.**
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F. W. W.	FREDERIC W. WHYTE. Author of *Actors of the Century*; &c. Translator of Filon's *English Stage*; Schilling's *With Flashlight and Rifle*; &c.	**Du Maurier, G.**
G. A. B.	GEORGE A. BOULENGER, F.R.S., D.SC., PH.D. In charge of the collections of Reptiles and Fishes, Department of Zoology, British Museum. Vice-President of the Zoological Society of London.	**Dory.**
G. Be.	GERTRUDE MARGARET LOTHIAN BELL. Author of *The Desert and the Sown*; &c.	**Druses** (*in part*).
G. B. M. G.	GEORGE BARNARD MILBANK COORE. Assistant Secretary, Board of Education, London.	**Education:** *National Systems.*
G. C. W.	GEORGE CHARLES WILLIAMSON, LITT.D. Chevalier of the Legion of Honour. Author of *Portrait Miniatures*; *Life of Richard Cosway, R.A.*; *George Englcheart*; *Portrait Drawings*; &c. Editor of new edition of Bryan's *Dictionary of Painters and Engravers.*	**Downman; Dumont, François.**
G. F. B.	G. F. BARWICK. Assistant Keeper of Printed Books and Superintendent of Reading Room, British Museum.	**Dhuleep Singh.**
G. G. S.	GEORGE GREGORY SMITH, M.A. Professor of English Literature, Queen's University of Belfast. Author of *The Days of James IV.*, *The Transition Period*; *Specimens of Middle Scots*; &c.	**Douglas, Gavin; Dunbar, William.**
G. H. Br.	GEORGE HARTLEY BRYAN, M.A., D.SC., F.R.S. Professor of Pure and Applied Mathematics, University College of North Wales. Formerly Fellow of Peterhouse, Cambridge. President of Mathematical Association, 1907.	**Diffusion.**
G. H. C.	GEORGE HERBERT CARPENTER, B.SC. Professor of Zoology in the Royal College of Science, Dublin. Author of *Insects: their Structure and Life.*	**Dragon-fly** (*in part*).
G. S. W.*	GEORGE STEPHEN WEST, M.A., D.SC., F.L.S. Professor of Botany, University of Birmingham. Associate of Royal College of Science, London. Author of *Treatise on British Fresh-water Algae*; &c.	**Diatomaceae** (*in part*).
H. A. Mi.	HENRY ALEXANDER MIERS, M.A., D.SC., F.R.S. Principal of the University of London. Fellow of Magdalen College, Oxford. Formerly Waynflete Professor of Mineralogy, Oxford. President of Mineralogical Society since 1904. Editor of the *Mineralogical Magazine*, 1891–1900. Author of *Mineralogy*; &c.	**Diamond.**
H. B. Wo.	HORACE BOLINGBROKE WOODWARD, F.R.S., F.G.S. Formerly Assistant Director of the Geological Survey of England and Wales. President, Geologists' Association, 1893–1894. Wollaston Medallist, 1908.	**Desmarest, N.**
H. Ch.	HUGH CHISHOLM, M.A. Formerly Scholar of Corpus Christi College, Oxford. Editor of the 11th edition of the *Encyclopaedia Britannica*; Co-editor of the 10th edition.	**Devonshire, Earls and Dukes of; Dufferin and Ava, 1st Marquess; Edward VII.**

H. De.	REV. HIPPOLYTE DELEHAYE, S.J. Bollandist. Joint Author of the *Acta Sanctorum*.	**Denis, Saint.**
H. F. Ba.	HENRY FREDERICK BAKER, M.A., D.Sc., F.R.S. Fellow and Lecturer of St John's College, Cambridge. Cayley Lecturer in Mathematics in the University. Author of *Abel's Theory and the Allied Theory*; &c.	**Differential Equation**
H. F. G.	HANS FRIEDRICH GADOW, M.A., F.R.S., PH.D. Strickland Curator and Lecturer on Zoology in the University of Cambridge. Author of *Amphibia and Reptiles* (Cambridge Natural History).	**Dodo** (*in part*).
H. G.	HUGH GODFRAY, M.A. Sometime Fellow of St John's College, Cambridge. Author of an *Elementary Treatise on the Lunar Theory*; *A Treatise on Astronomy*.	**Dial and Dialling.**
H. H. T.	HERBERT HALL TURNER, M.A., D.Sc., F.R.S. Savilian Professor of Astronomy, Oxford University. Fellow of New College. Formerly Fellow of Trinity College, Cambridge, and Chief Assistant at the Royal Observatory, Greenwich. Correspondent, Institut de France. President, Royal Astronomical Society, 1903–1904. Author of *Modern Astronomy*; *Astronomical Discovery*.	**Eclipse** (*in part*).
H. Lb.	HORACE LAMB, M.A., LL.D., D.Sc., F.R.S. Professor of Mathematics, University of Manchester. Formerly Fellow and Assistant Tutor of Trinity College, Cambridge. Member of Council of Royal Society, 1894–1896. Royal Medallist, 1902. President of London Mathematical Society, 1902–1904. Author of *Hydrodynamics*; &c.	**Dynamics.**
H. N. D.	HENRY NEWTON DICKSON, M.A., D.Sc., F.R.S. (Edin.), F.R.G.S. Professor of Geography at University College, Reading. Formerly Vice-President, Royal Meteorological Society. Lecturer in Physical Geography, Oxford. Author of *Meteorology*; *Elements of Weather and Climate*; &c.	**Desert.**
H. O. T.	HENRY OSBORN TAYLOR, LL.B. (Columbia). Author of *The Classical Heritage of the Middle Ages*; *Ancient Ideals*; &c.	**Dionysius Areopagiticus.**
H. St.	HENRY STURT, M.A. Author of *Idola Theatri*; *The Idea of a Free Church*; and *Personal Idealism*.	**Dühring.**
H. S. S.	HAROLD SPENCER SCOTT, M.A. New College, Oxford. Barrister-at-Law, Lincoln's Inn.	**Dower.**
H. Tl.	HENRY TIEDEMANN. London Editor of the *Nieuwe Rotterdamsche Courant*. Ex-President of the Foreign Press Association.	**Dozy.**
H. W. C. D.	HENRY WILLIAM CARLESS DAVIS, M.A. Fellow and Tutor of Balliol College, Oxford. Fellow of All Souls' College, Oxford, 1895–1902. Author of *England under the Normans and Angevins*; *Charlemagne*.	**Dermot MacMurrough**; **Edmund, Saint.**
H. W. H.	HOPE W. HOGG, M.A. Professor of Semitic Languages and Literatures in the University of Manchester.	**Edessa.**
I. A.	ISRAEL ABRAHAMS, M.A. Reader in Talmudic and Rabbinic Literature, University of Cambridge. President, Jewish Historical Society of England. Author of *A Short History of Jewish Literature*; *Jewish Life in the Middle Ages*.	**Dukes, Leopold**; **Dunash**; **Duran.**
J. A.*	JOHN AITKEN, LL.D., F.R.S. Investigator of Atmospheric Dust. Inventor of instruments for counting the dust particles in the atmosphere. Author of papers on Dust Fogs and Clouds; Hazing Effects of Atmospheric Dust; Cyclones and Anticyclones; &c., in publications of Royal Society.	**Dust.**
J. A. H.	JOHN ALLEN HOWE, B.Sc. Curator and Librarian of the Museum of Practical Geology, London.	**Devonian System**; **Drift.**
J. A. P.*	REV. JAMES ALEXANDER PATERSON, M.A., D.D. Professor of Hebrew and Old Testament Exegesis, New College, Edinburgh. Author of *The Period of the Judges*; *Book of Leviticus*, in "Temple" Bible; *Book of Numbers*, in "Polychrome" Bible; &c. Translator of Schultz's *Old Testament Theology*.	**Deuteronomy.**
J. C. M.	JAMES CLERK MAXWELL, D.C.L., F.R.S. See the biographical article: MAXWELL, JAMES CLERK.	**Diagram.**
J. F.-K.	JAMES FITZMAURICE-KELLY, LITT.D., F.R.HIST.S. Gilmour Professor of Spanish Language and Literature, Liverpool University. Norman McColl Lecturer, Cambridge University. Fellow of the British Academy. Member of the Royal Spanish Academy. Knight Commander of the Order of Alphonso XII. Author of *A History of Spanish Literature*; &c.	**Deus, João de**; **Don Juan**; **Echegaray y Eizaguirre.**
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J. H. G.	JOHANN HENDRIK GALLÉE, PH.D. Professor of Comparative Philology and Teutonic Languages, University of Utrecht. President of the Philological Society, Utrecht. Author of *Altsächsische Sprachdenkmäler*.	**Dutch Language.**
J. H. R.	JOHN HORACE ROUND, M.A., LL.D. (Edin.). Author of *Feudal England*; *Studies in Peerage and Family History*; *Peerage and Pedigree*; &c.	**Domesday Book**; **Earl**; **Earl Marshal.**
J. I.	JULES ISAAC. Professor of History at the Lycée of Lyons.	**Du Bellay, Guillaume and Jean.**

J. J. H.	J. J. Hummel, F.I.C. (d. 1902). Formerly Professor of Dyeing, University of Leeds. Author of *The Dyeing of Textile Fabrics.*	**Dyeing** (*in part*).
J. J. L.	Rev. John James Lias, M.A. Chancellor of Llandaff Cathedral. Formerly Hulsean Lecturer in Divinity and Lady Margaret Preacher, University of Cambridge.	**Döllinger.**
J. L. M.	John Linton Myres, M.A., F.S.A., F.R.G.S. Wykeham Professor of Ancient History in the University of Oxford. Formerly Gladstone Professor of Greek and Lecturer in Ancient Geography, University of Liverpool. Lecturer in Classical Archaeology in University of Oxford.	**Dorians.**
J. M.	John Milne, F.G.S., F.R.S., D.Sc. Formerly Professor of Mining and Geology, Imperial University of Tokio. Founder of the Seismic Survey of Japan. Designer of seismographs and instruments to record vibrations on railways, &c. Author of *Earthquakes*; *Seismology*; *Crystallography*; &c.	**Earthquake** (*in part*).
J. Mo.	Viscount Morley of Blackburn. See the biographical article: Morley, Viscount, of Blackburn.	**Diderot.**
J. M. M.	John Malcolm Mitchell. Sometime Scholar of Queen's College, Oxford. Lecturer in Classics, East London College (University of London). Joint Editor of Grote's *History of Greece.*	**Draco**; **Ecclesia.**
J. M. M. D.	J. M. M. Dallas. Formerly Secretary of the Edinburgh Draughts Club.	**Draughts** (*in part*).
J. O. B.	John Oliver Borley, M.A. Gonville and Caius College, Cambridge.	**Dredge and Dredging**: *Marin*
J. P.-B.	James George Joseph Penderel-Brodhurst. Editor of the *Guardian*, London.	**Desk.**
J. R. C.	Joseph Rogerson Cotter, M.A. Assistant to the Professor of Physics, Trinity College, Dublin. Editor of 2nd edition of Preston's *Theory of Heat.*	**Dispersion.**
J. R. F.	John Ritchie Findlay. See the biographical article: Findlay, J. R.	**De Quincey.**
J. R. Fo.	John R. Fothergill. Editor of *The Slade.*	**Drawing.**
J. S. F.	John Smith Flett, D.Sc., F.G.S. Petrographer to the Geological Survey. Formerly Lecturer on Petrology in Edinburgh University. Neill Medallist of the Royal Society of Edinburgh. Bigsby Medallist of the Geological Society of London.	**Diabase**; **Diorite**; **Dolerite**; **Dolomite**; **Eclogite.**
J. T. Be.	John T. Bealby. Joint Author of Stanford's *Europe.* Formerly Editor of the *Scottish Geographical Magazine.* Translator of Sven Hedin's *Through Asia, Central Asia and Tibet*; &c.	**Dnieper** (*in part*); **Dniester** (*in part*); **Don** (*in part*); **Don Cossacks, Territory of th** (*in part*); **Dvina** (*in part*); **Echmiadzin** (*in part*).
Jno. W.	John Westlake, K.C., LL.D., D.C.L. Professor of International Law, Cambridge, 1888–1908. One of the Members for United Kingdom of International Court of Arbitration under the Hague Convention, 1900–1906. Author of *A Treatise on Private International Law*; *International Law*: *I. Peace*; *II. War*; &c.	**Domicile.**
J. Wn.	James Welton, M.A. Professor of Education in the University of Leeds. Author of *Logical Bases of Education*; *Principles and Methods of Moral Training*; &c.	**Education**: *Theory.*
J. W. He.	James Wycliffe Headlam, M.A. Staff Inspector of Secondary Schools under the Board of Education. Formerly Fellow of King's College, Cambridge. Professor of Greek and Ancient History at Queen's College, London. Author of *Bismarck and the Foundation of the German Empire*; &c.	**Droysen, J. G.**
K. S.	Kathleen Schlesinger. Author of *The Instruments of the Orchestra*; &c.	**Double-Bass**; **Drone**; **Drum**; **Dulcimer.**
L. F. V.-H.	Leveson Francis Vernon-Harcourt, M.A., M.Inst.C.E. (1839–1907). Formerly Professor of Civil Engineering at University College, London. Author of *Rivers and Canals*; *Harbours and Docks*; *Civil Engineering as applied in Construction*; &c.	**Dock.**
L. J. S.	Leonard James Spencer, M.A., F.G.S. Assistant, Department of Mineralogy, British Museum. Formerly Scholar of Sidney Sussex College, Cambridge, and Harkness Scholar. Editor of the *Mineralogical Magazine.*	**Diallage**; **Diaspore**; **Diopside**; **Dioptase.**
L. V.*	Luigi Villari. Italian Foreign Office (Emigration Department). Formerly Newspaper Correspondent in East of Europe. Italian Vice-Consul in New Orleans, 1906; Philadelphia, 1907; and Boston, U.S.A., 1907–1910. Author of *Italian Life in Town and Country*, *Fire and Sword in the Caucasus*; &c.	**Diavolo, Fra**; **Doria.**
M. A. C.	Maurice Arthur Canney, M.A. Assistant Lecturer in Semitic Languages in the University of Manchester.	**Dorner.**

M. Br.	MISS MARGARET BRYANT.	**Dryden** (*in part*); **Dumas.**
M. F.	SIR MICHAEL FOSTER, K.C.B., D.C.L., D.Sc., LL.D., F.R.S. See the biographical article: FOSTER, SIR M.	**Du Bois-Reymond.**
M. G. D.	RT. HON. SIR MOUNTSTUART ELPHINSTONE GRANT-DUFF, G.C.S.I., F.R.S. (1829–1906). M.P. for the Elgin Burghs, 1857–1881. Under-Secretary of State for India, 1868–1874. Under-Secretary of State for the Colonies, 1880–1881. Governor of Madras, 1881–1886. President of the Royal Geographical Society, 1889–1893. President of the Royal Historical Society, 1892–1899. Author of *Studies in European Politics*; *Notes from a Diary*; &c.	**Derby, 14th Earl of.**
M. Ha.	MARCUS HARTOG, M.A., D.Sc., F.L.S. Professor of Zoology, University College, Cork. Author of *Protozoa* (in Cambridge Natural History); and papers for various scientific journals.	**Dinoflagellata.**
M. Ja.	MORRIS JASTROW, JR., PH.D. Professor of Semitic Languages, University of Pennsylvania, U.S.A. Author of *Religion of the Babylonians and Assyrians*; &c.	**Ea**; **Eabani.**
M. O. B. C.	MAXIMILIAN OTTO BISMARCK CASPARI, M.A. Reader in Ancient History at London University. Lecturer in Greek at Birmingham University, 1905–1908.	**Doris.**
N. M.	NORMAN MCLEAN, M.A. Fellow, Lecturer and Librarian of Christ's College, Cambridge. University Lecturer in Aramaic. Examiner for the Oriental Languages Tripos, and the Theological Tripos, at Cambridge.	**Dionysius Telmaharensis.**
N. M. B.	NICHOLAS MURRAY BUTLER. See the biographical article: BUTLER, N. M.	**Education**: *United States.*
N. W. T.	NORTHCOTE WHITBRIDGE THOMAS, M.A. Government Anthropologist to Southern Nigeria. Corresponding Member of the Société d'Anthropologie de Paris. Author of *Thought Transference*; *Kinship and Marriage in Australia*; &c.	**Demonology**; **Divination**; **Doll**; **Dreams.**
O. J. R. H.	OSBERT JOHN RADCLIFFE HOWARTH, M.A. Christ Church, Oxford. Geographical Scholar, 1901. Assistant Secretary of the British Association.	**Denmark**: *Geography and Statistics* (*in part*).
P. A. K.	PRINCE PETER ALEXEIVITCH KROPOTKIN. See the biographical article: KROPOTKIN, PRINCE P. A.	**Dnieper** (*in part*); **Dniester** (*in part*); **Don** (*in part*); **Don Cossacks, Territory of the** (*in part*); **Dvina** (*in part*); **Echmiadzin** (*in part*).
P. C. M.	PETER CHALMERS MITCHELL, F.R.S., M.A., D.Sc., LL.D. Secretary to the Zoological Society of London. University Demonstrator in Comparative Anatomy and Assistant to Linacre Professor at Oxford, 1888–1891. Lecturer on Biology at Charing Cross Hospital, 1892–1894; at London Hospital, 1894. Examiner in Biology to the Royal College of Physicians, 1892–1896, 1901–1903. Examiner in Zoology to the University of London, 1903.	**Dog** (*in part*).
P. C. Y.	PHILIP CHESNEY YORKE, M.A. Magdalen College, Oxford.	**Derby, 7th Earl of**; **Digby, Sir Everard**; **Digby, Sir Kenelm.**
P. Gi.	PETER GILES, M.A., LL.D., LITT.D. Fellow and Classical Lecturer of Emmanuel College, Cambridge, and University Reader in Comparative Philology. Late Secretary of the Cambridge Philological Society. Author of *Manual of Comparative Philology*; &c.	**E.**
P. G. K.	PAUL GEORGE KONODY. Art Critic of the *Observer* and the *Daily Mail*. Formerly Editor of *The Artist*. Author of *The Art of Walter Crane*; *Velasquez, Life and Work*; &c.	**Do[illegible].**
R.	LORD RAYLEIGH. See the biographical article: RAYLEIGH, 3RD BARON.	**Diffraction of Light.**
R. A. S. M.	ROBERT ALEXANDER STEWART MACALISTER, M.A., F.S.A. St John's College, Cambridge. Director of Excavations for the Palestine Exploration Fund.	**Diptych.**
R. C. J.	SIR RICHARD CLAVERHOUSE JEBB., LITT.D., D.C.L. See the biographical article: JEBB, SIR RICHARD C.	**Demosthenes.**
R. D. M.	R. D. MILNER. Formerly Assistant, U.S. Department of Agriculture.	**Dietetics** (*in part*).
R. H. D.*	ROBERT HENRY DAVIS. Managing Director, Siebe, Gorman & Co., Ltd., Submarine Engineers, London. Author of *A Diving Manual*; &c.	**Divers and Diving Apparatus.**
R. I. P.	REGINALD INNES POCOCK, F.Z.S. Superintendent of the Zoological Gardens, London.	**Earwig.**
R. J.	RICHARD JORDAN. Draughts Champion of Scotland, 1896, and of the world, 1896 seq.	**Draughts** (*in part*).
R. J. M.	RONALD JOHN MCNEILL, M.A. Christ Church, Oxford. Barrister-at-Law. Formerly Editor of the *St James's Gazette*, London.	**Driving**; **Durham, 1st Earl of,**

R. L.*	RICHARD LYDEKKER, F.R.S., F.G.S., F.Z.S. Member of the Staff of the Geological Survey of India, 1874–1882. Author of *Catalogues of Fossil Mammals, Reptiles and Birds in British Museum*; *The Deer of all Lands*; &c.	**Dingo**; **Dolphin**; **Dormouse**; **Dugong**; **Dulker**; **Edentata.**
R. Ma.	REV. ROBERT MACKINTOSH, D.D. Professor of Christian Ethics and Apologetics, Lancashire Independent College. Lecturer on the Philosophy of Religion, University of Manchester. Author of *Christ and the Jewish Law*; &c.	**Dogma.**
R. M'L.	ROBERT M'LACHLAN, F.R.S. Editor of the *Entomologists' Monthly Magazine.*	**Dragon-fly** (*in part*).
R. N. B.	ROBERT NISBET BAIN (d. 1909). Assistant Librarian, British Museum, 1883–1909. Author of *Scandinavia: the Political History of Denmark, Norway and Sweden, 1513–1900*; *The First Romanovs, 1613 to 1725*; *Slavonic Europe: the Political History of Poland and Russia from 1469 to 1796*; &c.	**Denmark**: *Medieval and Modern History*; **Dessewffy**; **Dlugosz**; **Dolgoruki**; **Dozsa.**
R. P. S.	R. PHENÉ SPIERS, F.S.A., F.R.I.B.A. Formerly Master of the Architectural School, Royal Academy, London. Past-President of Architectural Association. Associate and Fellow of King's College, London. Corresponding Member of the Institute of France. Editor of Fergusson's *History of Architecture*. Author of *Architecture: East and West*; &c.	**Dome**; **Door**; **Doorway**; **Early English Period.**
S. A. C.	STANLEY ARTHUR COOK. Editor for Palestine Exploration Fund. Lecturer in Hebrew and Syriac, and formerly Fellow, Gonville and Caius College, Cambridge. Examiner in Hebrew and Aramaic, London University, 1904–1908. Council of Royal Asiatic Society, 1904–1905. Author of *Glossary of Aramaic Inscriptions*; *The Laws of Moses and Code of Hammurabi*; *Critical Notes on Old Testament History*; *Religion of Ancient Palestine*; &c.	**Edom.**
St C.	VISCOUNT ST CYRES. See the biographical article: IDDESLEIGH, 1ST EARL OF.	**Du Vergier de Hauranne.**
St H.	LORD ST HELIER (SIR FRANCIS HENRY JEUNE), P.C., K.C.B., G.C.B. (1843–1905). President of the Probate, Divorce and Admiralty Division of the High Court of Justice, 1892–1905. Honorary Fellow of Hertford College, Oxford.	**Divorce.**
S. C.	SIDNEY COLVIN, LL.D. See the biographical article: COLVIN, S.	**Dürer.**
S. D. H.	S. D. HOPKINSON.	**Dividend.**
S. K.	STEN KONOW, PH.D. Professor of Indian Philology in the University of Christiania. Officier de l'Académie Française. Author of *Stamaṇidhāna brāhmaṇa*; *The Karpuramañjari*; volumes on Tibeto-Burman languages; *Munda and Dravidian*; "Mārāthi Bhil" in *The Linguistic Survey of India.*	**Dravidian.**
S. N.	SIMON NEWCOMB, LL.D. See the biographical article: NEWCOMB, SIMON.	**Eclipse** (*in part*); **Ecliptic.**
T. As.	THOMAS ASHBY, M.A., D.LITT., F.S.A. Director of the British School of Archaeology at Rome. Corresponding Member of the Imperial German Archaeological Institute. Formerly Scholar of Christ Church, Oxford. Craven Fellow, Oxford, 1897. Author of *The Classical Topography of the Roman Campagna*; &c.	**Eboli.**
T. A. I.	THOMAS ALLAN INGRAM, M.A., LL.D. Trinity College, Dublin.	**Desertion.**
T. F. T.	THOMAS FREDERICK TOUT, M.A. Professor of Medieval and Modern History in the University of Manchester. Formerly Fellow of Pembroke College, Oxford. Author of *Edward I.*; *The Empire and Papacy*; &c.	**Edward I., II., III.**; **Edward, The Black Prince.**
T. K. C.	REV. THOMAS KELLY CHEYNE, M.A., D.D. See the biographical article: CHEYNE, T. K.	**Eden.**
T. L. H.	SIR THOMAS LITTLE HEATH, K.C.B., D.SC. Assistant Secretary to the Treasury. Formerly Fellow of Trinity College, Cambridge. Author of *Diophantos of Alexandria*; Editor of *The Thirteen Books of Euclid's Elements*; &c.	**Diophantos.**
T. M. F.	THOMAS MCCALL FALLOW, M.A., F.S.A. Formerly Editor of the *Antiquary*. Author of *Memorials of Old Yorkshire*; *Cathedral Churches of Ireland*; &c.	**Easter.**
T. Se.	THOMAS SECCOMBE, M.A. Balliol College, Oxford. Lecturer in History, East London and Birkbeck Colleges (University of London). Stanhope Prizeman, Oxford, 1887. Assistant Editor of *Dictionary of National Biography*, 1891–1901. Author of *The Age of Johnson*; Joint Author of *The Bookman History of English Literature*; &c.	**Dickens**; **Dostoievsky.**
T. W. R. D.	T. W. RHYS DAVIDS, LL.D., PH.D. Professor of Comparative Religion, Manchester. Professor of Pali and Buddhist Literature, University College, London, 1882–1904. President of the Pali Text Society. Fellow of the British Academy. Secretary and Librarian of Royal Asiatic Society, 1885–1902. Author of *Buddhism*; *Sacred Books of the Buddhists*; *Early Buddhism*; *Buddhist India*; *Dialogues of the Buddha*; &c.	**Devadatta**; **Dhammapāla.**

V. T.	VLADIMIR TCHERTKOFF. Editor of *The Free Age Press*. Literary Representative of Leo Tolstoy. Author of *Christian Martyrdom in Russia*; &c.	**Doukhobors.**
W. A. B. C.	REV. WILLIAM AUGUSTUS BREVOORT COOLIDGE, M.A., F.R.G.S., PH.D. (Bern). Fellow of Magdalen College, Oxford. Professor of English History, St David's College, Lampeter, 1880–1881. Author of *Guide du Haut Dauphiné*; *The Range of the Tödi*; *Guide to Grindelwald*; *Guide to Switzerland*; *The Alps in Nature and in History*; &c. Editor of the *Alpine Journal*, 1880–1889; &c.	**Digne; Dolomites, The; Dornbirn; Durance; Ebel, J. G.**
W. A. P.	WALTER ALISON PHILLIPS, M.A. Formerly Exhibitioner of Merton College and Senior Scholar of St John's College, Oxford. Author of *Modern Europe*; &c.	**Diplomacy; Dispensation; Donation of Constantine; Dragon; Duke; Eastern Question, The.**
W. A. S. H.	WILLIAM ALBERT SAMUEL HEWINS, M.A. Secretary of the Tariff Commission. Formerly Director of the London School of Economics. Teacher of Modern Economic History in the University of London, 1902–1903. Tooke Professor of Economic Science and Statistics at King's College, London, 1897–1903. Author of *Imperialism and its Probable Effect on the Commercial Policy of the United Kingdom*; &c.	**Economics.**
W. B.	WALTER BAXENDALE. Kennel Editor of the *Field*.	**Dog** (*in part*).
W. E. B.	REV. WILLIAM EMERY BARNES, M.A., D.D. Hulsean Professor of Divinity, Cambridge. Fellow and Hon. Chaplain of Peterhouse, Cambridge. Examining Chaplain to the Bishop of London. Joint Editor of *Journal of Theological Studies*, 1899–1901. Formerly Lecturer in Hebrew, Clare College, and Lecturer in Hebrew and Divinity, Peterhouse. Author of *The Canonical and Uncanonical Gospels*; *The Peshitta Text of Chronicles*; *The Psalms in the Peshitta Version*; *Genuineness of Isaiah*; &c.	**Ecclesiasticus.**
W. E. D.	WILLIAM ERNEST DALBY, M.A., M.INST.C.E., M.I.M.E., A.M.INST.N.A. Professor of Civil and Mechanical Engineering at the City and Guilds of London Institute Central Technical College, South Kensington. Formerly University Demonstrator in the Engineering Department, Cambridge. Author of *The Balancing of Engines*; *Valves and Valve Gear Mechanism*; &c.	**Dynamometer.**
W. F. Sh.	WILLIAM FLEETWOOD SHEPPARD, M.A. Senior Examiner to the Board of Education. Formerly Fellow of Trinity College, Cambridge. Senior Wrangler, 1884.	**Differences, Calculus of.**
W. F. W.	WALTER FRANCIS WILLCOX, LL.B., PH.D. Chief Statistician, United States Census Bureau. Professor of Social Science and Statistics, Cornell University. Member of the American Social Science Association and Secretary of the American Economical Association. Author of *The Divorce Problem: A Study in Statistics*; *Social Statistics of the United States*; &c.	**Divorce:** *United States.*
W. G. F. P.	SIR WALTER GEORGE FRANK PHILLIMORE, BART., D.C.L., LL.D. Judge of the King's Bench Division. President of International Law Association, 1905. Author of *Book of Church Law*. Editor of 2nd edition of *Phillimore's Ecclesiastical Law*; 3rd edition of vol. iv. of *Phillimore's International Law*; &c.	**Ecclesiastical Jurisdiction.**
W. Hy.	WILLIAM HENRY. Founder and Chief Secretary to the Royal Life Saving Society. Associate of the Order of St John of Jerusalem. Joint Author of *Swimming* (Badminton Library); &c.	**Drowning and Life Saving.**
W. H.*	WALTER HUNTER, M.I.C.E., M.I.M.E., F.G.S. Consulting Engineer for Waterworks to Crown Agents for the Colonies. Member of Council of Institute of Civil Engineers. Silver Medallist, Royal Society of Arts. Originator of Staines Scheme of Storage Reservoirs. Has reported on Waterworks at Accra, Secconder and Lagos; also on Rand Water Supply.	**Dredge and Dredging:** *Hydraulic Engineering.*
W. H. Ma.	WILLIAM HENRY MAXWELL, A.M.I.C.E. Borough and Waterworks Engineer, Tunbridge Wells. Formerly President of Institute of Sanitary Engineers, London. Author of *Refuse Destructors*; &c. Joint Editor of *Encyclopaedia of Municipal and Sanitary Engineering*.	**Destructors.**
W. L. G.	WILLIAM LAWSON GRANT, M.A. Professor at Queen's University, Kingston, Canada. Formerly Beit Lecturer in Colonial History at Oxford University. Editor of *Acts of the Privy Council*, Colonial series; *Canadian Constitutional Development* (in collaboration).	**Dorchester, 1st Baron.**
W. M.	WILLIAM MINTO, M.A. See the biographical article: MINTO, WILLIAM.	**Drydon** (*in part*).
W. M. R.	WILLIAM MICHAEL ROSSETTI. See the biographical article: ROSSETTI, DANTE GABRIEL.	**Dolci; Domenichino; Dyce, William; Eastlake.**
W. N. S.	WILLIAM NAPIER SHAW, M.A., LL.D., D.Sc., F.R.S. Director of the Meteorological Office. Reader in Meteorology in the University of London. President of Permanent International Meteorological Committee. Member of Meteorological Council, 1897–1905. Hon. Fellow of Emmanuel College, Cambridge. Senior Tutor, 1890–1899. Joint Author of *Text Book of Practical Physics*; &c.	**Dew.**

W. O. A.	WILBUR OLIN ATWATER, PH.D. (1844–1907). Formerly Professor of Chemistry, Wesleyan University, U.S.A. Special Agent of the United States Department of Agriculture in charge of Nutrition Investigations.	**Dietetics** (*in part*).
W. R. E. H.	WILLIAM RICHARD EATON HODGKINSON, PH.D., F.R.S. Professor of Chemistry and Physics, Ordnance College, Woolwich. Formerly Professor of Chemistry and Physics, R.M.A., Woolwich. Past Author of Valentin-Hodgkinson's *Practical Chemistry*; &c.	**Dynamite.**
W. R. L.	W. R. LETHABY, F.S.A. Principal of the Central School of Arts and Crafts under the London County Council. Author of *Architecture, Mysticism and Myth*; &c.	**Design**
W. S. J.	WILLIAM STANLEY JEVONS, LL.D. See the biographical article: JEVONS, WILLIAM STANLEY.	**De Morgan.**
W. W.	WILLIAM WALLACE. See the biographical article: WALLACE, WILLIAM (1844–1897).	**Descartes.**
W. W. R.*	WILLIAM WALKER ROCKWELL, PH.D. Assistant Professor of Church History, Union Theological Seminary, New York.	**Dort, Synod of.**

PRINCIPAL UNSIGNED ARTICLES

Democratic Party.
Democritus.
Derbyshire.
Desmoulins.
Detroit.
Devonshire.
De Witt, John.
Diabetes.
Diamond Necklace.
Dice.
Dictionary.
Didachē.
Dietary.
Dietrich of Bern.
Digitalis.
Dijon.
Dionysius.
Diphtheria.
Distress.
Dittersdorf, Karl D. von.
Divining-rod.
Dockyards.
Doge.
Dominoes.
Donatists.
Donegal.
Dorset, Earls, Marquesses and Dukes of.
Dorsetshire.
Douglas: *Family.*
Dover.
Down.
Dragoman.
Drainage of Land.
Drake, Sir Francis.
Dresden.
Dropsy.
Drummond of Hawthornden.
Drunkenness.
Dualism.
Dublin.
Dunbar.
Dundee, Viscount.
Dundee: *City.*
Dundonald.
Duns Scotus.
Durban.
Durham.
Dutch East India Company.
Dutch West India Company.
Dwarf.
Dyaks.
Dysentery.
Dyspepsia.
Earth.
Eastern Bengal and Assam.
East India Company.
Ebionites.
Ecarté.
Ecclesiastical Law.
Eclecticism.
Edgeworth.
Edinburgh.
Edinburghshire.

ENCYCLOPÆDIA BRITANNICA

ELEVENTH EDITION

VOLUME VIII

DEMIJOHN, a glass bottle or jar with a large round body and narrow neck, encased in wicker-work and provided with handles. The word is also used of an earthenware jar, similarly covered with wicker. The capacity of a demijohn varies from two to twelve gallons, but the common size contains five gallons. According to the *New English Dictionary* the word is an adaptation of a French *Dame Jeanne*, or Dame Jane, an application of a personal name to an object which is not uncommon; cf. the use of "Toby" for a particular form of jug and the many uses of the name "Jack."

DEMISE, an Anglo-French legal term (from the Fr. *démettre*, Lat. *dimittere*, to send away) for a transfer of an estate, especially by lease. The word has an operative effect in a lease implying a covenant for "quiet enjoyment" (see LANDLORD AND TENANT). The phrase "demise of the crown" is used in English law to signify the immediate transfer of the sovereignty, with all its attributes and prerogatives, to the successor without any interregnum in accordance with the maxim "the king never dies." At common law the death of the sovereign *eo facto* dissolved parliament, but this was abolished by the Representation of the People Act 1867, § 51. Similarly the common law doctrine that all offices held under the crown determined at its demise has been negatived by the Demise of the Crown Act 1901. "Demise" is thus often used loosely for death or decease.

DEMIURGE (Gr. δημιουργός, from δήμιος, of or for the people, and ἔργον, work), a handicraftsman or artisan. In Homer the word has a wide application, including not only hand-workers but even heralds and physicians. In Attica the demiurgi formed one of the three classes (with the Eupatridae and the geomori, georgi or agroeci) into which the early population was divided (cf. Arist. *Ath. Pol.* xiii. 2). They represented either a class of the whole population, or, according to Busolt, a commercial nobility (see EUPATRIDAE). In the sense of "worker for the people" the word was used throughout the Peloponnese, with the exception of Sparta, and in many parts of Greece, for a higher magistrate. The demiurgi among other officials represent Elis and Mantineia at the treaty of peace between Athens, Argos, Elis and Mantineia in 420 B.C. (Thuc. v. 47). In the Achaean League (*q.v.*) the name is given to ten elective officers who presided over the assembly, and Corinth sent "Epidemiurgi" every year to Potidaea, officials who apparently answered to the Spartan harmosts. In Plato δημιουργός is the name given to the "creator of the world" (*Timaeus*, 40) and the word was so adopted by the Gnostics (see GNOSTICISM).

DEMMIN, a town of Germany, kingdom of Prussia, on the navigable river Peene (which in the immediate neighbourhood receives the Trebel and the Tollense), 72 m. W.N.W. of Stettin, on the Berlin-Stralsund railway. Pop. (1905) 12,541. It has manufactures of textiles, besides breweries, distilleries and tanneries, and an active trade in corn and timber.

The town is of Slavonian origin and of considerable antiquity, and was a place of importance in the time of Charlemagne. It was besieged by a German army in 1148, and captured by Henry the Lion in 1164. In the Thirty Years' War Demmin was the object of frequent conflicts, and even after the peace of Westphalia was taken and retaken in the contest between the electoral prince and the Swedes. It passed to Prussia in 1720, and its fortifications were dismantled in 1759. In 1807 several engagements took place in the vicinity between the French and Russians.

DEMOCHARES (*c.* 355–275 B.C.), nephew of Demosthenes, Athenian orator and statesman, was one of the few distinguished Athenians in the period of decline. He is first heard of in 322, when he spoke in vain against the surrender of Demosthenes and the other anti-Macedonian orators demanded by Antipater. During the next fifteen years he probably lived in exile. On the restoration of the democracy by Demetrius Poliorcetes in 307 he occupied a prominent position, but was banished in 303 for having ridiculed the decree of Stratocles, which contained a fulsome eulogy of Demetrius. He was recalled in 298, and during the next four years [1] fortified and equipped the city with provisions and ammunition. In 296 (or 295) he was again banished for having concluded an alliance with the Boeotians, and did not return until 287 (or 286). In 280 he induced the Athenians to erect a public monument in honour of his uncle with a suitable inscription. After his death (some five years later) the son of Democharcs proposed and obtained a decree (Plutarch, *Vitae decem oratorum*, p. 851) that a statue should be erected in his honour, containing a record of his public services, which seem to have consisted in a reduction of public expenses, a more prudent management of the state finances (after his return in 287) and successful begging missions to the rulers of Egypt and Macedonia. Although a friend of the Stoic Zeno, Democharcs regarded all other philosophers as the enemies of freedom, and in 306 supported the proposal of one Sophocles, advocating their expulsion from Attica. According to Cicero (*Brutus*, 83) Democharcs was the author of a history of his own times, written in an oratorical rather than a historical style. As a speaker he was noted for his freedom of language (*Parrhesiastes*, Seneca, *De ira*, iii. 23). He was violently attacked by Timaeus, but found a strenuous defender in Polybius (xii. 13).

See also Plutarch, *Demosthenes*, 30, *Demetrius*, 24, *Vitae decem oratorum*, p. 847; J. G. Droysen's essay on Democharcs in *Zeitschrift für die Altertumswissenschaft* (1836), Nos. 20, 21.

DEMOCRACY (Gr. δημοκρατία, from δῆμος, the people, *i.e.* the commons, and κράτος, rule), in political science, that form of government in which the people rules itself, either directly, as in the small city-states of Greece, or through representatives. According to Aristotle, democracy is the perverted form of the

[1] For the "four years' war" and the chronological questions involved, see C. W. Müller, *Frag. Hist. Graec.* ii. 445.

third form of government, which he called πολιτεία, "polity" or "constitutional government," the rule of the majority of the free and equal citizens, as opposed to monarchy and aristocracy, the rule respectively of an individual and of a minority consisting of the best citizens (see GOVERNMENT and ARISTOCRACY). Aristotle's restriction of "democracy" to *bad* popular government, *i.e.* mob-rule, or, as it has sometimes been called, "ochlocracy" (ὄχλος, mob), was due to the fact that the Athenian democracy had in his day degenerated far below the ideals of the 5th century, when it reached its zenith under Pericles. Since Aristotle's day the word has resumed its natural meaning, but democracy in modern times is a very different thing from what it was in its best days in Greece and Rome. The Greek states were what are known as "city-states," the characteristic of which was that all the citizens could assemble together in the city at regular intervals for legislative and other purposes. This sovereign assembly of the people was known at Athens as the Ecclesia (*q.v.*), at Sparta as the Apella (*q.v.*), at Rome variously as the Comitia Centuriata or the Concilium Plebis (see COMITIA). Of representative government in the modern sense there is practically no trace in Athenian history, though certain of the magistrates (see STRATEGUS) had a quasi-representative character. Direct democracy is impossible except in small states. In the second place the qualification for citizenship was rigorous; thus Pericles restricted citizenship to those who were the sons of an Athenian father, himself a citizen, and an Athenian mother (ἐξ ἀμφοῖν ἀστοῖν). This system excluded not only all the slaves, who were more numerous than the free population, but also resident aliens, subject allies, and those Athenians whose descent did not satisfy this criterion (τῷ γένει μὴ καθαροί). The Athenian democracy, which was typical in ancient Greece, was a highly exclusive form of government.

With the growth of empire and nation states this narrow parochial type of democracy became impossible. The population became too large and the distance too great for regular assemblies of qualified citizens. The rigid distinction of citizens and non-citizens was progressively more difficult to maintain, and new criteria of citizenship came into force. The first difficulty has been met by various forms of representative government. The second problem has been solved in various ways in different countries; moderate democracies have adopted a low property qualification, while extreme democracy is based on the extension of citizenship to all adult persons with or without distinction of sex. The essence of modern representative government is that the people does not govern itself, but periodically elects those who shall govern on its behalf (see GOVERNMENT; REPRESENTATION).

DEMOCRATIC PARTY, originally DEMOCRATIC-REPUBLICAN PARTY, the oldest of existing political parties in the United States. Its origin lay in the principles of local self-government and repugnance to social and political aristocracy established as cardinal tenets of American colonial democracy, which by the War of Independence, which was essentially a democratic movement, became the basis of the political institutions of the nation. The evils of lax government, both central and state, under the Confederation caused, however, a marked anti-democratic reaction, and this united with the temperamental conservatism of the framers of the constitution of 1787 in the shaping of that conservative instrument. The influences and interests for and against its adoption took form in the groupings of Federalists and Anti-Federalists, and these, after the creation of the new government, became respectively, in underlying principles, and, to a large extent, in personnel, the Federalist party (*q.v.*) and the Democratic-Republican party.[1] The latter, organized by Thomas Jefferson in opposition to the Federalists dominated by Alexander Hamilton, was a real party by 1792. The great service of attaching to the constitution a democratic bill of rights belongs to the Anti-Federalists or Democratic-Republican party, although this was then amorphous. The Democratic-Republican party gained full control of the government, save the judiciary, in 1801, and controlled it continuously thereafter until 1824. No political "platforms" were then known, but the writings of Jefferson, who dominated his party throughout this period, take the place of such. His inaugural address of 1801 is a famous statement of democratic principles, which to-day are taken for granted only because, through the party organized by him to secure their success, they became universally accepted as the ideal of American institutions. In all the colonies, says John Adams, "a court and a country party had always contended"; Jefferson's followers believed sincerely that the Federalists were a new court party, and monarchist. Hence they called themselves "Republicans" as against monarchists,—standing also, incidentally, for states' rights against the centralization that monarchy (or any approach to it) implied; and "Democrats" as against aristocrats,—standing for the "common rights of Englishmen," the "rights of man," the levelling of social ranks and the widening of political privileges. In the early years of its history—and during the period of the French Revolution and afterwards—the Republicans sympathized with the French as against the British, the Federalists with the British as against the French.

Devotion to abstract principles of democracy and liberty, and in practical politics a strict construction of the constitution, in order to prevent an aggrandizement of national power at the expense of the states (which were nearer popular control) or the citizens, have been permanent characteristics of the Democratic party as contrasted with its principal opponents; but neither these nor any other distinctions have been continuously or consistently true throughout its long course.[2] After 1801 the commercial and manufacturing nationalistic[3] elements of the Federalist party, being now dependent on Jefferson for protection, gradually went over to the Republicans, especially after the War of 1812; moreover, administration of government naturally developed in Republican ranks a group of broad-constructionists. These groups fused, and became an independent party.[4] They called themselves *National* Republicans, while the Jacksonian Republicans soon came to be known simply as Democrats.[5] Immediately afterward followed the tremendous victory of the Jacksonians in 1828,—a great advance in radical democracy over the victory of 1800. In the interval the Federalist party had disappeared, and practically the entire country, embracing Jeffersonian democracy, had passed through the school of the Republican party. It had established the power of the "people" in the sense of that word in present-day American politics. Bills of rights in every state constitution protected the citizen; some state judges were already elective; very soon the people came to nominate their presidential candidates in national conventions, and draft their party platforms through their convention representatives.[6] After the National Republican scission the Democratic party, weakened thereby in its nationalistic tendencies, and deprived of the leadership of Jackson, fell quickly under the control of its Southern adherents and became virtually sectional in its objects. Its states' rights doctrine was turned to the defence of slavery. In thus opposing anti-slavery sentiment—inconsistently, alike as regarded the "rights of man" and constitutional construction, with its original and permanent

[1] The prefix "Democratic" was not used by Jefferson; it became established, however, and official.

[2] Under the rubric of "strict construction" fall the greatest struggles in the party's history: those over the United States Bank, over tariffs—for protection or for "revenue" only, over "internal improvements," over issues of administrative economy in providing for the "general welfare," &c. The course of the party has frequently been inconsistent, and its doctrines have shown, absolutely considered, progressive latitudinarianism.

[3] "Nationalistic" is used here and below, not in the sense of a general nationalistic spirit, such as that of Jackson, but to indicate the centralizing tendency of a broad construction of constitutional powers in behalf of commerce and manufactures.

[4] Standing for protective tariffs, internal improvements, &c.

[5] It should be borne in mind, however, that the Democratic party of Jackson was not strictly *identical* with the Democratic-Republican party of Jefferson,—and some writers date back the origin of the present Democratic party only to 1828–1829.

[6] The Democratic national convention of 1832 was preceded by an Anti-Masonic convention of 1830 and by the National-Republican convention of 1831; but the Democratic platform of 1840 was the first of its kind.

principles—it lost morale and power. As a result of the contest over Kansas it became fatally divided, and in 1860 put forward two presidential tickets: one representing the doctrine of Jefferson Davis that the constitution recognized slave-property, and therefore the national government must protect slavery in the territories; the other representing Douglas's doctrine that the inhabitants of a territory might virtually exclude slavery by "unfriendly legislation." The combined popular votes for the two tickets exceeded that cast by the new anti-slavery Republican party (the second of the name) for Lincoln; but the election was lost. During the ensuing Civil War such members of the party as did not become War Democrats antagonized the Lincoln administration, and in 1864 made the great blunder of pronouncing the war "a failure." Owing to Republican errors in reconstruction and the scandals of President Grant's administration, the party gradually regained its strength and morale, until, having largely subordinated Southern questions to economic issues, it cast for Tilden for president in 1876 a popular vote greater than that obtained by the Republican candidate, Hayes, and gained control of the House of Representatives. The Electoral Commission, however, made Hayes president, and the quiet acceptance of this decision by the Democratic party did it considerable credit.

Since 1877 the Southern states have been almost solidly Democratic; but, except on the negro question, such unanimity among Southern whites has been, naturally, factitious; and by no means an unmixed good for the party. Apart from the "Solid South," the period after 1875 is characterized by two other party difficulties. The first was the attempt from 1878 to 1896 to "straddle" the silver issue;[1] the second, an attempt after 1896 to harmonize general elements of conservatism and radicalism within the party. In 1896 the South and West gained control of the organization, and the national campaigns of 1896 and 1900 were fought and lost mainly on the issue of "free silver," which, however, was abandoned before 1904. After 1898 "imperialism," to which the Democrats were hostile, became another issue. Finally, after 1896 there became very apparent in the party a tendency to attract the radical elements of society in the general re-alignment of parties taking place on industrial-social issues; the Democratic party apparently attracting, in this readjustment, the "radicals" and the "masses" as in the time of Jefferson and Jackson. In this process, in the years 1896–1900, it took over many of the principles and absorbed, in large part, the members of the radical third-party of the "Populists," only to be confronted thereupon by the growing strength of Socialism, challenging it to a farther radical widening of its programme. From 1860 to 1908 it elected but a single president (Grover Cleveland, 1885–1889 and 1893–1897).[2] All American parties accepted long ago in theory "Jeffersonian democracy"; but the Democratic party has been "the political champion of those elements of the [American] democracy which are most democratic. It stands nearest the people."[3] It may be noted that the Jeffersonian Republicans did not attempt to democratize the constitution itself. The choice of a president was soon popularized, however, in effect; and the popular election of United States senators is to-day a definite Democratic tenet.[4]

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[1] The attitude of the Republican party was no less inconsistent and evasive.

[2] It controlled the House of Representatives from 1874 to 1894 except in 1880–1882 and 1888–1890; but except for a time in Cleveland's second term, there were never simultaneously a Democratic president and a Democratic majority in Congress.

[3] Professor A. D. Morse in *International Monthly*, October 1900. He adds, "It has done more to Americanize the foreigner than all other parties." (It is predominant in the great cities of the country.)

[4] In connexion with the prevalent popular tendency to regard the president as a people's tribune, it may be noted that a strong presidential veto is, historically, peculiarly a Democratic contribution, owing to the history of Jackson's (compare Cleveland's) administration.

DEMOCRITUS, probably the greatest of the Greek physical philosophers, was a native of Abdera in Thrace, or as some say—probably wrongly—of Miletus (Diog. Laërt. ix. 34). Our knowledge of his life is based almost entirely on tradition of an untrustworthy kind. He seems to have been born about 470 or 460 B.C., and was, therefore, an older contemporary of Socrates. He inherited a considerable property, which enabled him to travel widely in the East in search of information. In Egypt he settled for seven years, during which he studied the mathematical and physical systems of the ancient schools. The extent to which he was influenced by the Magi and the Eastern astrologists is a matter of pure conjecture. He returned from his travels impoverished; one tradition says that he received 500 talents from his fellow-citizens, and that a public funeral was decreed him. Another tradition states that he was regarded as insane by the Abderitans, and that Hippocrates was summoned to cure him. Diodorus Siculus tells us that he died at the age of ninety; others make him as much as twenty years older. His works, according to Diogenes Laërtius, numbered seventy-two, and were characterized by a purity of style which compares favourably with that of Plato. The absurd epithet, the "laughing philosopher," applied to him by some unknown and very superficial thinker, may possibly have contributed in some measure to the fact that his importance was for centuries overlooked. It is interesting, however, to notice that Bacon (*De Principiis*) assigns to him his true place in the history of thought, and points out that both in his own day and later "in the times of Roman learning" he was spoken of in terms of the highest praise. In the variety of his knowledge, and in the importance of his influence on both Greek and modern speculation he was the Aristotle of the 5th century, while the sanity of his metaphysical theory has led many to regard him as the equal, if not the superior, of Plato.

His views may be treated under the following heads:—

1. *The Atoms and Cosmology* (adopted in part at least from the doctrines of Leucippus, though the relations between the two are hopelessly obscure). While agreeing with the Eleatics as to the eternal sameness of Being (nothing can arise out of nothing; nothing can be reduced to nothing), Democritus followed the physicists in denying its oneness and immobility. Movement and plurality being necessary to explain the phenomena of the universe and impossible without space (not-Being), he asserted that the latter had an equal right with Being to be considered existent. Being is the Full (πλῆρες, *plenum*); not-Being is the Void (κενόν, *vacuum*), the infinite space in which moved the infinite number of atoms into which the single Being of the Eleatics was broken up. These atoms are eternal and invisible; absolutely small, so small that their size cannot be

diminished (hence the name ἄτομος, "indivisible"); absolutely full and incompressible, they are without pores and entirely fill the space they occupy; homogeneous, differing only in figure (as A from N), arrangement (as AN from NA), position (as N is Z on its side), magnitude (and consequently in weight, although some authorities dispute this). But while the atoms thus differ in quantity, their differences of quality are only apparent, due to the impressions caused on our senses by different configurations and combinations of atoms. A thing is only hot or cold, sweet or bitter, hard or soft by convention (νόμῳ); the only things that exist in reality (ἐτεῇ) are the atoms and the void. Locke's distinction between primary and secondary qualities is here anticipated. Thus, the atoms of water and iron are the same, but those of the former, being smooth and round, and therefore unable to hook on to one another, roll over and over like small globes, whereas the atoms of iron, being rough, jagged and uneven, cling together and form a solid body. Since all phenomena are composed of the same eternal atoms (just as a tragedy and a comedy contain the same letters) it may be said that nothing comes into being or perishes in the absolute sense of the words (cf. the modern "indestructibility of matter" and "conservation of energy"), although the compounds of the atoms are liable to increase and decrease, appearance and disappearance —in other words, to birth and death. As the atoms are eternal and uncaused, so is motion; it has its origin in a preceding motion, and so on *ad infinitum*. For the Love and Hate of Empedocles and the *Nous* (Intelligence) of Anaxagoras, Democritus substituted fixed and necessary laws (not chance; that is a misrepresentation due chiefly to Cicero). Everything can be explained by a purely mechanical (but not fortuitous) system, in which there is no room for the idea of a providence or an intelligent cause working with a view to an end. The origin of the universe was explained as follows. An infinite number of atoms was carried downwards through infinite space. The larger (and heavier), falling with greater velocity, overtook and collided with the smaller (and lighter), which were thereby forced upwards. This caused various lateral and contrary movements, resulting in a whirling movement (δίνη) resembling the rotation of Anaxagoras, whereby similar atoms were brought together (as in the winnowing of grain) and united to form larger bodies and worlds. Atoms and void being infinite in number and extent, and motion having always existed, there must always have been an infinite number of worlds, all consisting of similar atoms, in various stages of growth and decay.

2. *The Soul.*—Democritus devoted considerable attention to the structure of the human body, the noblest portion of which he considered to be the soul, which everywhere pervades it, a psychic atom being intercalated between two corporeal atoms. Although, in accordance with his principles, Democritus was bound to regard the soul as material (composed of round, smooth, specially mobile atoms, identified with the fire-atoms floating in the air), he admitted a distinction between it and the body, and is even said to have looked upon it as something divine. These all pervading soul atoms exercise different functions in different organs; the head is the seat of reason, the heart of anger, the liver of desire. Life is maintained by the inhalation of fresh atoms to replace those lost by exhalation, and when respiration, and consequently the supply of atoms, ceases, the result is death. It follows that the soul perishes with, and in the same sense as, the body.

3. *Perception.*—Sensations are the changes produced in the soul by external impressions, and are the result of contact, since every action of one body (and all representations are corporeal phenomena) upon another is of the nature of a shock. Certain emanations (ἀπορῥοαί, ἀπόῤῥοιαι) or images (εἴδωλα), consisting of subtle atoms, thrown off from the surface of an object, penetrate the body through the pores. On the principle that like acts upon like, the particular senses are only affected by that which resembles them. We see by means of the eye alone, and hear by means of the ear alone, these organs being best adapted to receive the images or sound currents. The organs are thus merely conduits or passages through which the atoms pour into the soul. The eye, for example, is damp and porous, and the act of seeing consists in the reflection of the image (δείκελον) mirrored on the smooth moist surface of the pupil. To the interposition of air is due the fact that all visual images are to some extent blurred. At the same time Democritus distinguished between obscure (σκοτίη) cognition, resting on sensation alone, and genuine (γνησίη), which is the result of inquiry by reason, and is concerned with atoms and void, the only real existences. This knowledge, however, he confessed was exceedingly difficult to attain.

It is in Democritus first that we find a real attempt to explain colour. He regards black, red, white and green as primary. White is characteristically smooth, *i.e.* casting no shadow, even, flat; black is uneven, rough, shadowy and so on. The other colours result from various mixtures of these four, and are infinite in number. Colour itself is not objective; it is found not in the ultimate *plenum* and *vacuum*, but only in derived objects according to their physical qualities and relations.

4. *Theology.*—The system of Democritus was altogether antitheistic. But, although he rejected the notion of a deity taking part in the creation or government of the universe, he yielded to popular prejudice so far as to admit the existence of a class of beings, of the same form as men, grander, composed of very subtle atoms, less liable to dissolution, but still mortal, dwelling in the upper regions of air. These beings also manifested themselves to man by means of images in dreams, communicated with him, and sometimes gave him an insight into the future. Some of them were benevolent, others malignant. According to Plutarch, Democritus recognized one god under the form of a fiery sphere, the soul of the world, but this idea is probably of later origin. The popular belief in gods was attributed by Democritus to the desire to explain extraordinary phenomena (thunder, lightning, earthquakes) by reference to superhuman agency.

5. *Ethics.*—Democritus's moral system—the first collection of ethical precepts which deserves the name—strongly resembles the negative side of the system of Epicurus. The *summum bonum* is the maximum of pleasure with the minimum of pain. But true pleasure is not sensual enjoyment; it has its principle in the soul. It consists not in the possession of wealth or flocks and herds, but in good humour, in the just disposition and constant tranquillity of the soul. Hence the necessity of avoiding extremes; too much and too little are alike evils. True happiness consists in taking advantage of what one has and being content with it (see ETHICS).

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DEMOGEOT, JACQUES CLAUDE (1808–1894), French man of letters, was born in Paris on the 5th of July 1808. He was professor of rhetoric at the lycée Saint Louis, and subsequently assistant professor at the Sorbonne. He wrote many detached papers on various literary subjects, and two reports on secondary education in England and Scotland in collaboration with H. Montucci. His reputation rests on his excellent *Histoire de la littérature française depuis ses origines jusqu'à nos jours* (1851), which has passed through many subsequent editions. He was also the author of a *Tableau de la littérature française au XVIIe siècle* (1859), and of a work (3 vols., 1880–1883) on the influence of foreign literatures on the development of French literature. He died in Paris in 1894.

DEMOGRAPHY (from Gr. δῆμος, people, and γράφειν, to write), the science which deals with the statistics of health and

disease, of the physical, intellectual, physiological and economical aspects of births, marriages and mortality. The first to employ the word was Achille Guillard in his *Éléments de statistique humaine ou démographie comparée* (1855), but the meaning which he attached to it was merely that of the science which treats of the condition, general movement and progress of population in civilized countries, *i.e.* little more than what is comprised in the ordinary vital statistics, gleaned from census and registration reports. The word has come to have a much wider meaning and may now be defined as that branch of statistics which deals with the life-conditions of peoples.

DEMOIVRE, ABRAHAM (1667–1754), English mathematician of French extraction, was born at Vitry, in Champagne, on the 26th of May 1667. He belonged to a French Protestant family, and was compelled to take refuge in England at the revocation of the edict of Nantes, in 1685. Having laid the foundation of his mathematical studies in France, he prosecuted them further in London, where he read public lectures on natural philosophy for his support. The *Principia mathematica* of Sir Isaac Newton, which chance threw in his way, caused him to prosecute his studies with vigour, and he soon became distinguished among first-rate mathematicians. He was among the intimate personal friends of Newton, and his eminence and abilities secured his admission into the Royal Society of London in 1697, and afterwards into the Academies of Berlin and Paris. His merit was so well known and acknowledged by the Royal Society that they judged him a fit person to decide the famous contest between Newton and G. W. Leibnitz (see INFINITESIMAL CALCULUS). The life of Demoivre was quiet and uneventful. His old age was spent in obscure poverty, his friends and associates having nearly all passed away before him. He died at London, on the 27th of November 1754.

The *Philosophical Transactions* contain several of his papers. He also published some excellent works, such as *Miscellanea analytica de seriebus et quadraturis* (1730), in 4to. This contained some elegant and valuable improvements on then existing methods, which have themselves, however, long been superseded. But he has been more generally known by his *Doctrine of Chances, or Method of Calculating the Probabilities of Events at Play*. This work was first printed in 1718, in 4to, and dedicated to Sir Isaac Newton. It was reprinted in 1738, with great alterations and improvements; and a third edition was afterwards published with additions in 1756. He also published a *Treatise on Annuities* (1725), which has passed through several revised and corrected editions.

See C. Hutton, *Mathematical and Philosophical Dictionary* (1815). For *Demoivre's Theorem* see TRIGONOMETRY *Analytical*.

DEMONETIZATION, a term employed in monetary science in two different senses. (*a*) The depriving or divesting of a metal of its standard monetary value. From 1663 to 1717 silver was the standard of value in England and gold coins passed at their market value. The debasement and underrating of the silver coinage insensibly brought about the demonetization of silver in England as a standard of value and the substitution of gold. During the latter half of the 19th century, the tremendous depreciation of silver, owing to its continually increasing production, and consequently the impossibility of preserving any ratio of stability between it and gold, led to the abandonment or demonetization of the metal as a standard and to its use merely as token money. (*b*) The withdrawal of coin from circulation, as, for example, in England that of all pre-Victorian gold coins under the provisions of the Coinage Act 1889, and the royal proclamation of the 22nd of November 1890.

DEMONOLOGY (Δαίμων, demon, genius, spirit), the branch of the science of religions which relates to superhuman beings which are not gods. It deals both with benevolent beings which have no circle of worshippers or so limited a circle as to be below the rank of gods, and with malevolent beings of all kinds. It may be noted that the original sense of "demon" was a benevolent being; but in English the name now connotes malevolence; in German it has a neutral sense, *e.g. Korndämonen*. Demons, when they are regarded as spirits, may belong to either of the classes of spirits recognized by primitive animism (*q.v.*); that is to say, they may be human, or non-human, separable souls, or discarnate spirits which have never inhabited a body; a sharp distinction is often drawn between these two classes, notably by the Melanesians, the West Africans and others; the Arab *jinn*, for example, are not reducible to modified human souls; at the same time these classes are frequently conceived as producing identical results, *e.g.* diseases.

Under the head of demons are classified only such spirits as are believed to enter into relations with the human race; the term therefore includes (1) human souls regarded as genii or familiars, (2) such as receive a cult (for which see ANCESTOR WORSHIP), and (3) ghosts or other malevolent revenants; excluded are souls conceived as inhabiting another world. But just as gods are not necessarily spiritual, demons may also be regarded as corporeal; vampires for example are sometimes described as human heads with appended entrails, which issues from the tomb to attack the living during the night watches. The so-called Spectre Huntsman of the Malay Peninsula is said to be a man who scours the firmament with his dogs, vainly seeking for what he could not find on earth—a buck mouse-deer pregnant with male offspring; but he seems to be a living man; there is no statement that he ever died, nor yet that he is a spirit. The incubus and succubus of the middle ages are sometimes regarded as spiritual beings; but they were held to give very real proof of their bodily existence. It should, however, be remembered that primitive peoples do not distinguish clearly between material and immaterial beings.

Prevalence of Demons.—According to a conception of the world frequently found among peoples of the lower cultures, all the affairs of life are supposed to be under the control of spirits, each ruling a certain element or even object, and themselves in subjection to a greater spirit. Thus, the Eskimo are said to believe in spirits of the sea, earth and sky, the winds, the clouds and everything in nature. Every cove of the seashore, every point, every island and prominent rock has its guardian spirit. All are of the malignant type, to be propitiated only by acceptable offerings from persons who desire to visit the locality where it is supposed to reside. A rise in culture often results in an increase in the number of spiritual beings with whom man surrounds himself. Thus, the Koreans go far beyond the Eskimo and number their demons by thousands of billions; they fill the chimney, the shed, the living-room, the kitchen, they are on every shelf and jar; in thousands they waylay the traveller as he leaves his home, beside him, behind him, dancing in front of him, whirring over his head, crying out upon him from air, earth and water.

Especially complicated was the ancient Babylonian demonology; all the petty annoyances of life—a sudden fall, a headache, a quarrel—were set down to the agency of fiends; all the stronger emotions—love, hate, jealousy and so on—were regarded as the work of demons; in fact so numerous were they, that there were special fiends for various parts of the human body—one for the head, another for the neck, and so on. Similarly in Egypt at the present day the *jinn* are believed to swarm so thickly that it is necessary to ask their permission before pouring water on the ground, lest one should accidentally be soused and vent his anger on the offending human being. But these beliefs are far from being confined to the uncivilized; Greek philosophers like Porphyry, no less than the fathers of the Church, held that the world was pervaded with spirits; side by side with the belief in witchcraft, we can trace through the middle ages the survival of primitive animistic views; and in our own day even these beliefs subsist in unsuspected vigour among the peasantry of the more uneducated European countries. In fact the ready acceptance of spiritualism testifies to the force with which the primitive animistic way of looking at things appealed to the white races in the middle of the last century.

Character of Spiritual World.—The ascription of malevolence to the world of spirits is by no means universal. In West Africa the Mpongwe believe in local spirits, just as do the Eskimo; but they are regarded as inoffensive in the main; true, the passer-by must make some trifling offering as he nears their place of abode; but it is only occasionally that mischievous acts, such as the throwing down of a tree on a passer-by, are, in the view of the

natives, perpetuated by the Ombuiri. So too, many of the spirits especially concerned with the operations of nature are conceived as neutral or even benevolent; the European peasant fears the corn-spirit only when he irritates him by trenching on his domain and taking his property by cutting the corn; similarly, there is no reason why the more insignificant personages of the pantheon should be conceived as malevolent, and we find that the *Petara* of the Dyaks are far from indiscriminating and malignant, though disease and death are laid at their door.

Classification. Besides the distinctions of human and non-human, hostile and friendly, the demons in which the lower races believe are classified by them according to function, each class with a distinctive name, with extraordinary minuteness, the list in the case of the Malays running to several score. They have, for example, a demon of the waterfall, a demon of wild-beast tracks, a demon which interferes with snares for wild-fowl, a baboon demon, which takes possession of dancers and causes them to perform wonderful feats of climbing, &c. But it is impossible to do more than deal with a few types, which will illustrate the main features of the demonology of savage, barbarous and semi-civilized peoples.

(*a*) Natural causes, either of death or of disease, are hardly, if at all, recognized by the uncivilized; everything is attributed to spirits or magical influence of some sort. The spirits which cause disease may be human or non-human and their influence is shown in more than one way; they may enter the body of the victim (see POSSESSION), and either dominate his mind as well as his body, inflict specific diseases, or cause pains of various sorts. Thus the Mintra of the Malay Peninsula have a demon corresponding to every kind of disease known to them; the Tasmanian ascribed a gnawing pain to the presence within him of the soul of a dead man, whom he had unwittingly summoned by mentioning his name and who was devouring his liver; the Samoan held that the violation of a food tabu would result in the animal being formed within the body of the offender and cause his death. The demon theory of disease is still attested by some of our medical terms; epilepsy (Gr. ἐπίληψις, seizure) points to the belief that the patient is possessed. As a logical consequence of this view of disease the mode of treatment among peoples in the lower stages of culture is mainly magical; they endeavour to propitiate the evil spirits by sacrifice, to expel them by spells, &c. (see EXORCISM), to drive them away by blowing, &c.; conversely we find the Khonds attempt to keep away smallpox by placing thorns and brushwood in the paths leading to places decimated by that disease, in the hope of making the disease demon retrace his steps. This theory of disease disappeared sooner than did the belief in possession; the energumens (ἐνεργούμενοι) of the early Christian church, who were under the care of a special clerical order of exorcists, testify to a belief in possession; but the demon theory of disease receives no recognition; the energumens find their analogues in the converts of missionaries in China, Africa and elsewhere. Another way in which a demon is held to cause disease is by introducing itself into the patient's body and sucking his blood; the Malays believe that a woman who dies in childbirth becomes a *langsuir* and sucks the blood of children; victims of the lycanthrope are sometimes said to be done to death in the same way; and it is commonly believed in Africa that the wizard has the power of killing people in this way, probably with the aid of a familiar.

(*b*) One of the primary meanings of δαίμων is that of genius or familiar, tutelary spirit; according to Hesiod the men of the golden race became after death guardians or watchers over mortals. The idea is found among the Romans also; they attributed to every man a genius who accompanied him through life. A Norse belief found in Iceland is that the *fylgia*, a genius in animal form, attends human beings; and these animal guardians may sometimes be seen fighting; in the same way the Siberian shamans send their animal familiars to do battle instead of deciding their quarrels in person. The animal guardian reappears in the *nagual* of Central America (see article TOTEMISM), the *yunbeai* of some Australian tribes, the *manitou* of the Red Indian and the bush soul of some West African tribes; among the latter the link between animal and human being is said to be established by the ceremony of the blood bond. Corresponding to the animal guardian of the ordinary man, we have the familiar of the witch or wizard. All the world over it is held that such people can assume the form of animals; sometimes the power of the shaman is held to depend on his being able to summon his familiar; among the Ostiaks the shaman's coat was covered with representations of birds and beasts; two bear's claws were on his hands; his wand was covered with mouse-skin; when he wished to divine he beat his drum till a black bird appeared and perched on his hut; then the shaman swooned, the bird vanished, and the divination could begin. Similarly the Greenland *angekok* is said to summon his *torngak* (which may be an ancestral ghost or an animal) by drumming; he is heard by the bystanders to carry on a conversation and obtain advice as to how to treat diseases, the prospects of good weather and other matters of importance. The familiar, who is sometimes replaced by the devil, commonly figured in witchcraft trials; and a statute of James I. enacted that all persons invoking an evil spirit or consulting, covenanting with, entertaining, employing, feeding or rewarding any evil spirit should be guilty of felony and suffer death. In modern spiritualism the familiar is represented by the "guide," corresponding to which we have the theosophical "guru."

(*c*) The familiar is sometimes an ancestral spirit, and here we touch the fringe of the cult of the dead (see also ANCESTOR WORSHIP). Especially among the lower races the dead are regarded as hostile; the Australian avoids the grave even of a kinsman and elaborate ceremonies of mourning are found amongst most primitive peoples, whose object seems to be to rid the living of the danger they run by association with the ghost of the dead. Among the Zulu the spirits of the dead are held to be friendly or hostile, just as they were in life; on the Congo a man after death joins the good or bad spirits according as his life has been good or bad. Especially feared among many peoples are the souls of those who have committed suicide or died a violent death; the woman who dies in childbed is held to become a demon of the most dangerous kind; even the unburied, as restless, dissatisfied spirits, are more feared than ordinary ghosts. Naturally spirits of these latter kinds are more valuable as familiars than ordinary dead men's souls. We find many recipes for securing their aid. In the Malay Peninsula the blood of a murdered man must be put in a bottle and prayers said over; after seven days of this worship a sound is heard and the operator puts his finger into the bottle for the polong, as the demon is called, to suck; it will fly through the air in the shape of an exceedingly diminutive female figure, and is always preceded by its pet, the pelesit, in the shape of a grasshopper. In Europe a similar demon is said to be obtainable from a cock's egg. In South Africa and India, on the other hand, the magician digs up a dead body, especially of a child, to secure a familiar. The evocation of spirits, especially in the form of necromancy, is an important branch of the demonology of many peoples; and the peculiarities of trance mediumship, which seem sufficiently established by modern research, go far to explain the vogue of this art. It seems to have been common among the Jews, and the case of the witch of Endor is narrated in a way to suggest something beyond fraud; in the book of magic which bears the name of Dr Faustus may be found many of the formulae for raising demons; in England may be mentioned especially Dr Dee as one of the most famous of those who claimed before the days of modern spiritualism (*q.v.*) to have intercourse with the unseen world and to summon demons at his will. Sometimes the spirits were summoned to appear as did the phantoms of the Greek heroes to Odysseus; sometimes they were called to enter a crystal (see CRYSTAL-GAZING); sometimes they are merely asked to declare the future or communicate by moving external objects without taking a visible form; thus among the Karens at the close of the burial ceremonies the ghost of the dead man, which is said to hover round till the rites are completed, is believed to make a ring swing round and snap the string from which it hangs.

(*d*) The vampire is a particular form of demon which calls for

some notice. In the Malay Peninsula, parts of Polynesia, &c., it is conceived as a head with attached entrails, which issues, it may be from the grave, to suck the blood of living human beings. According to the Malays a *penanggalan* (vampire) is a living witch, and can be killed if she can be caught; she is especially feared in houses where a birth has taken place and it is the custom to hang up a bunch of thistle in order to catch her; she is said to keep vinegar at home to aid her in re-entering her own body. In Europe the Slavonic area is the principal seat of vampire beliefs, and here too we find, as a natural development, that means of preventing the dead from injuring the living have been evolved by the popular mind. The corpse of the vampire, which may often be recognized by its unnaturally ruddy and fresh appearance, should be staked down in the grave or its head should be cut off; it is interesting to note that the cutting off of heads of the dead was a neolithic burial rite.

(*e*) The vampire is frequently blended in popular idea with the *Poltergeist* (*q.v.*) or knocking spirit, and also with the werwolf (see LYCANTHROPY).

(*f*) As might be expected, dream demons are very common; in fact the word "nightmare" (A.S. *mar*, spirit, elf) preserves for us a record of this form of belief, which is found right down to the lowest planes of culture. The Australian, when he suffers from an oppression in his sleep, says that Koin is trying to throttle him; the Caribs say that Maboya beats them in their sleep; and the belief persists to this day in some parts of Europe; horses too are said to be subject to the persecutions of demons, which ride them at night. Another class of nocturnal demons are the incubi and succubi, who are said to consort with human beings in their sleep; in the Antilles these were the ghosts of the dead; in New Zealand likewise ancestral deities formed liaisons with females; in the Samoan Islands the inferior gods were regarded as the fathers of children otherwise unaccounted for; the Hindus have rites prescribed by which a companion nymph may be secured. The question of the real existence of incubi and succubi, whom the Romans identified with the fauns, was gravely discussed by the fathers of the church; and in 1484 Innocent III. set forth the doctrine of lecherous demons as an indisputable fact; and in the history of the Inquisition and of trials for witchcraft may be found the confessions of many who bore witness to their reality. In the *Anatomy of Melancholy* Burton assures us that they were never more numerous than in A.D. 1600.

(*g*) Corresponding to the personal tutelary spirit (*supra, b*) we have the genii of buildings and places. The Romans celebrated the birthday of a town and of its genius, just as they celebrated that of a man; and a snake was a frequent form for this kind of demon; when we compare with this the South African belief that the snakes which are in the neighbourhood of the kraal are the incarnations of the ancestors of the residents, it seems probable that some similar idea lay at the bottom of the Roman belief; to this day in European folklore the house snake or toad, which lives in the cellar, is regarded as the "life index" or other self of the father of the house; the death of one involves the death of the other, according to popular belief. The assignment of genii to buildings and gates is connected with an important class of sacrifices; in order to provide a tutelary spirit, or to appease chthonic deities, it was often the custom to sacrifice a human being or an animal at the foundation of a building; sometimes we find a similar guardian provided for the frontier of a country or of a tribe. The house spirit is, however, not necessarily connected with this idea. In Russia the *domovoi* (house spirit) is an important personage in folk-belief; he may object to certain kinds of animals, or to certain colours in cattle; and must, generally speaking, be propitiated and cared for. Corresponding to him we have the drudging goblin of English folklore.

(*h*) It has been shown above how the animistic creed postulates the existence of all kinds of local spirits, which are sometimes tied to their habitats, sometimes free to wander. Especially prominent in Europe, classical, medieval and modern, and in East Asia, is the spirit of the lake, river, spring, or well, often conceived as human, but also in the form of a bull or horse; the term Old Nick may refer to the water-horse Nök. Less specialized in their functions are many of the figures of modern folklore, some of whom have perhaps replaced some ancient goddess, *e.g.* Frau Holda; others, like the Welsh Pwck, the Lancashire boggarts or the more widely found Jack-o'-Lantern (Will o' the Wisp), are sprites who do no more harm than leading the wanderer astray. The banshee is perhaps connected with ancestral or house spirits; the Wild Huntsman, the Gabriel hounds, the Seven Whistlers, &c., are traceable to some actual phenomenon; but the great mass of British goblindom cannot now be traced back to savage or barbarous analogues. Among other local sprites may be mentioned the kobolds or spirits of the mines. The fairies (see FAIRY), located in the fairy knolls by the inhabitants of the Shetlands, may also be put under this head.

(*i*) The subject of plant souls is referred to in connexion with animism (*q.v.*); but certain aspects of this phase of belief demand more detailed treatment. Outside the European area vegetation spirits of all kinds seem to be conceived, as a rule, as anthropomorphic; in classical Europe, and parts of the Slavonic area at the present day, the tree spirit was believed to have the form of a goat, or to have goats' feet.

Of special importance in Europe is the conception of the so-called "corn spirit"; W. Mannhardt collected a mass of information proving that the life of the corn is supposed to exist apart from the corn itself and to take the form, sometimes of an animal, sometimes of a man or woman, sometimes of a child. There is, however, no proof that the belief is animistic in the proper sense. The animal which popular belief identified with the corn demon is sometimes killed in the spring in order to mingle its blood or bones with the seed; at harvest-time it is supposed to sit in the last corn and the animals driven out from it are sometimes killed; at others the reaper who cuts the last ear is said to have killed the "wolf" or the "dog," and sometimes receives the name of "wolf" or "dog" and retains it till the next harvest. The corn spirit is also said to be hiding in the barn till the corn is threshed, or it may be said to reappear at midwinter, when the farmer begins to think of his new year of labour and harvest. Side by side with the conception of the corn spirit as an animal is the anthropomorphic view of it; and this element must have predominated in the evolution of the cereal deities like Demeter; at the same time traces of the association of gods and goddesses of corn with animal embodiments of the corn spirit are found.

(*j*) In many parts of the world, and especially in Africa, is found the conception termed the "otiose creator"; that is to say, the belief in a great deity, who is the author of all that exists but is too remote from the world and too high above terrestrial things to concern himself with the details of the universe. As a natural result of this belief we find the view that the operations of nature are conducted by a multitude of more or less obedient subordinate deities; thus, in Portuguese West Africa the Kimbunda believe in Suku-Vakange, but hold that he has committed the government of the universe to innumerable *kilulu* good and bad; the latter kind are held to be far more numerous, but Suku-Vakange is said to keep them in order by occasionally smiting them with his thunderbolts; were it not for this, man's lot would be insupportable.

Sometimes the gods of an older religion degenerate into the demons of the belief which supersedes it. A conspicuous example of this is found in the attitude of the Hebrew prophets to the gods of the nations, whose power they recognize without admitting their claim to reverence and sacrifice. The same tendency is seen in many early missionary works and is far from being without influence even at the present day. In the folklore of European countries goblindom is peopled by gods and nature-spirits of an earlier heathendom. We may also compare the Persian *devs* with the Indian *devas*.

Expulsion of Demons.—In connexion with demonology mention must be made of the custom of expelling ghosts, spirits or evils generally. Primitive peoples from the Australians upwards celebrate, usually at fixed intervals, a driving out of hurtful influences. Sometimes, as among the Australians, it is merely the ghosts of those who have died in the year which are thus

driven out; from this custom must be distinguished another, which consists in dismissing the souls of the dead at the close of the year and sending them on their journey to the other world; this latter custom seems to have an entirely different origin and to be due to love and not fear of the dead. In other cases it is believed that evil spirits generally or even non-personal evils such as sins are believed to be expelled. In these customs originated perhaps the scapegoat, some forms of sacrifice (*q.v.*) and other cathartic ceremonies.

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(N. W. T.)

DE MORGAN, AUGUSTUS (1806–1871), English mathematician and logician, was born in June 1806, at Madura, in the Madras presidency. His father, Colonel John De Morgan, was employed in the East India Company's service, and his grandfather and great-grandfather had served under Warren Hastings. On the mother's side he was descended from James Dodson, F.R.S., author of the *Anti-logarithmic Canon* and other mathematical works of merit, and a friend of Abraham Demoivre. Seven months after the birth of Augustus, Colonel De Morgan brought his wife, daughter and infant son to England, where he left them during a subsequent period of service in India, dying in 1816 on his way home.

Augustus De Morgan received his early education in several private schools, and before the age of fourteen years had learned Latin, Greek and some Hebrew, in addition to acquiring much general knowledge. At the age of sixteen years and a half he entered Trinity College, Cambridge, and studied mathematics, partly under the tuition of Sir G. B. Airy. In 1825 he gained a Trinity scholarship. De Morgan's love of wide reading somewhat interfered with his success in the mathematical tripos, in which he took the fourth place in 1827. He was prevented from taking his M.A. degree, or from obtaining a fellowship, by his conscientious objection to signing the theological tests then required from masters of arts and fellows at Cambridge.

A career in his own university being closed against him, he entered Lincoln's Inn; but had hardly done so when the establishment, in 1828, of the university of London, in Gower Street, afterwards known as University College, gave him an opportunity of continuing his mathematical pursuits. At the early age of twenty-two he gave his first lecture as professor of mathematics in the college which he served with the utmost zeal and success for a third of a century. His connexion with the college, indeed, was interrupted in 1831, when a disagreement with the governing body caused De Morgan and some other professors to resign their chairs simultaneously. When, in 1836, his successor was accidentally drowned, De Morgan was requested to resume the professorship.

In 1837 he married Sophia Elizabeth, daughter of William Frend, a Unitarian in faith, a mathematician and actuary in occupation, a notice of whose life, written by his son-in-law, will be found in the *Monthly Notices of the Royal Astronomical Society* (vol. v.). They settled in Chelsea (30 Cheyne Row), where in later years Mrs De Morgan had a large circle of intellectual and artistic friends.

As a teacher of mathematics De Morgan was unrivalled. He gave instruction in the form of continuous lectures delivered extempore from brief notes. The most prolonged mathematical reasoning, and the most intricate formulae, were given with almost infallible accuracy from the resources of his extraordinary memory. De Morgan's writings, however excellent, give little idea of the perspicuity and elegance of his viva voce expositions, which never failed to fix the attention of all who were worthy of hearing him. Many of his pupils have distinguished themselves, and, through Isaac Todhunter and E. J. Routh, he had an important influence on the later Cambridge school. For thirty years he took an active part in the business of the Royal Astronomical Society, editing its publications, supplying obituary notices of members, and for eighteen years acting as one of the honorary secretaries. He was also frequently employed as consulting actuary, a business in which his mathematical powers, combined with sound judgment and business-like habits, fitted him to take the highest place.

De Morgan's mathematical writings contributed powerfully towards the progress of the science. His memoirs on the "Foundation of Algebra," in the 7th and 8th volumes of the *Cambridge Philosophical Transactions*, contain some of the most important contributions which have been made to the philosophy of mathematical method; and Sir W. Rowan Hamilton, in the preface to his *Lectures on Quaternions*, refers more than once to those papers as having led and encouraged him in the working out of the new system of quaternions. The work on *Trigonometry and Double Algebra* (1849) contains in the latter part a most luminous and philosophical view of existing and possible systems of symbolic calculus. But De Morgan's influence on mathematical science in England can only be estimated by a review of his long series of publications, which commence, in 1828, with a translation of part of Bourdon's *Elements of Algebra*, prepared for his students. In 1830 appeared the first edition of his well-known *Elements of Arithmetic*, which did much to raise the character of elementary training. It is distinguished by a simple yet thoroughly philosophical treatment of the ideas of number and magnitude, as well as by the introduction of new abbreviated processes of computation, to which De Morgan always attributed much practical importance. Second and third editions were called for in 1832 and 1835; a sixth edition was issued in 1876. De Morgan's other principal mathematical works were *The Elements of Algebra* (1835), a valuable but somewhat dry elementary treatise; the *Essay on Probabilities* (1838), forming the 107th volume of *Lardner's Cyclopaedia*, which forms a valuable introduction to the subject; and *The Elements of Trigonometry and Trigonometrical Analysis, preliminary to the Differential Calculus* (1837). Several of his mathematical works were published by the Society for the Diffusion of Useful Knowledge, of which De Morgan was at one time an active member. Among these may be mentioned the *Treatise on the Differential and Integral Calculus* (1842); the *Elementary Illustrations of the Differential and Integral Calculus*, first published in 1832, but often bound up with the larger treatise; the essay, *On the Study and Difficulties of Mathematics* (1831); and a brief treatise on *Spherical Trigonometry* (1834). By some accident the work on probability in the same series, written by Sir J. W. Lubbock and J. Drinkwater-Bethune, was attributed to De Morgan, an error which seriously annoyed his nice sense of bibliographical accuracy. For fifteen years he did all in his power to correct the mistake, and finally wrote to *The Times* to disclaim the authorship. (See *Monthly Notices* of the Royal Astronomical Society, vol. xxvi. p. 118.) Two of his most elaborate treatises are to be found in the *Encyclopaedia metropolitana*, namely the articles on the Calculus of Functions, and the Theory of Probabilities. De Morgan's minor mathematical writings were scattered over various periodicals. A list of these and other papers will be found in the *Royal Society's Catalogue*, which contains forty-two entries under the name of De Morgan.

In spite, however, of the excellence and extent of his mathematical writings, it is probably as a logical reformer that De Morgan will be best remembered. In this respect he stands alongside of his great contemporaries Sir W. R. Hamilton and George Boole, as one of several independent discoverers of the all-important principle of the quantification of the predicate. Unlike most mathematicians, De Morgan always laid much stress upon the importance of logical training. In his admirable papers upon the modes of teaching arithmetic and geometry, originally published in the *Quarterly Journal of Education* (reprinted in *The Schoolmaster*, vol. ii.), he remonstrated against the neglect of

logical doctrine. In 1839 he produced a small work called *First Notions of Logic*, giving what he had found by experience to be much wanted by students commencing with *Euclid*. In October 1846 he completed the first of his investigations, in the form of a paper printed in the *Transactions of the Cambridge Philosophical Society* (vol. viii. No. 29). In this paper the principle of the quantified predicate was referred to, and there immediately ensued a memorable controversy with Sir W. R. Hamilton regarding the independence of De Morgan's discovery, some communications having passed between them in the autumn of 1846. The details of this dispute will be found in the original pamphlets, in the *Athenaeum* and in the appendix to De Morgan's *Formal Logic*. Suffice it to say that the independence of De Morgan's discovery was subsequently recognized by Hamilton. The eight forms of proposition adopted by De Morgan as the basis of his system partially differ from those which Hamilton derived from the quantified predicate. The general character of De Morgan's development of logical forms was wholly peculiar and original on his part.

Late in 1847 De Morgan published his principal logical treatise, called *Formal Logic, or the Calculus of Inference, Necessary and Probable*. This contains a reprint of the *First Notions*, an elaborate development of his doctrine of the syllogism, and of the numerical definite syllogism, together with chapters of great interest on probability, induction, old logical terms and fallacies. The severity of the treatise is relieved by characteristic touches of humour, and by quaint anecdotes and allusions furnished from his wide reading and perfect memory. There followed at intervals, in the years 1850, 1858, 1860 and 1863, a series of four elaborate memoirs on the "Syllogism," printed in volumes ix. and x. of the *Cambridge Philosophical Transactions*. These papers taken together constitute a great treatise on logic, in which he substituted improved systems of notation, and developed a new logic of relations, and a new onymatic system of logical expression. In 1860 De Morgan endeavoured to render their contents better known by publishing a *Syllabus of a Proposed System of Logic*, from which may be obtained a good idea of his symbolic system, but the more readable and interesting discussions contained in the memoirs are of necessity omitted. The article "Logic" in the *English Cyclopaedia* (1860) completes the list of his logical publications.

Throughout his logical writings De Morgan was led by the idea that the followers of the two great branches of exact science, logic and mathematics, had made blunders,—the logicians in neglecting mathematics, and the mathematicians in neglecting logic. He endeavoured to reconcile them, and in the attempt showed how many errors an acute mathematician could detect in logical writings, and how large a field there was for discovery. But it may be doubted whether De Morgan's own system, "horrent with mysterious spiculae," as Hamilton aptly described it, is fitted to exhibit the real analogy between quantitative and qualitative reasoning, which is rather to be sought in the logical works of Boole.

Perhaps the largest part, in volume, of De Morgan's writings remains still to be briefly mentioned; it consists of detached articles contributed to various periodical or composite works. During the years 1833–1843 he contributed very largely to the first edition of the *Penny Cyclopaedia*, writing chiefly on mathematics, astronomy, physics and biography. His articles of various length cannot be less in number than 850, and they have been estimated to constitute a sixth part of the whole *Cyclopaedia*, of which they formed perhaps the most valuable portion. He also wrote biographies of Sir Isaac Newton and Edmund Halley for Knight's *British Worthies*, various notices of scientific men for the *Gallery of Portraits*, and for the uncompleted *Biographical Dictionary* of the Useful Knowledge Society, and at least seven articles in Smith's *Dictionary of Greek and Roman Biography*. Some of De Morgan's most interesting and useful minor writings are to be found in the *Companions to the British Almanack*, to which he contributed without fail one article each year from 1831 up to 1857 inclusive. In these carefully written papers he treats a great variety of topics relating to astronomy, chronology, decimal coinage, life assurance, bibliography and the history of science. Most of them are as valuable now as when written.

Among De Morgan's miscellaneous writings may be mentioned his *Explanation of the Gnomonic Projection of the Sphere*, 1836, including a description of the maps of the stars, published by the Useful Knowledge Society; his *Treatise on the Globes, Celestial and Terrestrial*, 1845, and his remarkable *Book of Almanacks* (2nd edition, 1871), which contains a series of thirty-five almanacs, so arranged with indices of reference, that the almanac for any year, whether in old style or new, from any epoch, ancient or modern, up to A.D. 2000, may be found without difficulty, means being added for verifying the almanac and also for discovering the days of new and full moon from 2000 B.C. up to A.D. 2000. De Morgan expressly draws attention to the fact that the plan of this book was that of L. B. Francoeur and J. Ferguson, but the plan was developed by one who was an unrivalled master of all the intricacies of chronology. The two best tables of logarithms, the small five-figure tables of the Useful Knowledge Society (1839 and 1857), and Shroen's Seven Figure-Table (5th ed., 1865), were printed under De Morgan's superintendence. Several works edited by him will be found mentioned in the *British Museum Catalogue*. He made numerous anonymous contributions through a long series of years to the *Athenaeum*, and to *Notes and Queries*, and occasionally to *The North British Review*, *Macmillan's Magazine*, &c.

Considerable labour was spent by De Morgan upon the subject of decimal coinage. He was a great advocate of the pound and mil scheme. His evidence on this subject was sought by the Royal Commission, and, besides constantly supporting the Decimal Association in periodical publications, he published several separate pamphlets on the subject.

One marked characteristic of De Morgan was his intense and yet reasonable love of books. He was a true bibliophil, and loved to surround himself, as far as his means allowed, with curious and rare books. He revelled in all the mysteries of watermarks, title-pages, colophons, catch-words and the like; yet he treated bibliography as an important science. As he himself wrote, "the most worthless book of a bygone day is a record worthy of preservation; like a telescopic star, its obscurity may render it unavailable for most purposes; but it serves, in hands which know how to use it, to determine the places of more important bodies." His evidence before the Royal Commission on the British Museum in 1850 (Questions 5704* 5815,* 6481-6513, and 8966-8967), should be studied by all who would comprehend the principles of bibliography or the art of constructing a catalogue, his views on the latter subject corresponding with those carried out by Panizzi in the *British Museum Catalogue*. A sample of De Morgan's bibliographical learning is to be found in his account of *Arithmetical Books, from the Invention of Printing* (1847), and finally in his *Budget of Paradoxes*. This latter work consists of articles most of which were originally published in the *Athenaeum*, describing the various attempts which have been made to invent a perpetual motion, to square the circle, or to trisect the angle; but De Morgan took the opportunity to include many curious bits gathered from his extensive reading, so that the *Budget*, as reprinted by his widow (1872), with much additional matter prepared by himself, forms a remarkable collection of scientific *ana*. De Morgan's correspondence with contemporary scientific men was very extensive and full of interest. It remains unpublished, as does also a large mass of mathematical tracts which he prepared for the use of his students, treating all parts of mathematical science, and embodying some of the matter of his lectures. De Morgan's library was purchased by Lord Overstone, and presented to the university of London.

In 1866 his life became clouded by the circumstances which led him to abandon the institution so long the scene of his labours. The refusal of the council to accept the recommendation of the senate, that they should appoint an eminent Unitarian minister to the professorship of logic and mental philosophy, revived all De Morgan's sensitiveness on the subject of sectarian freedom; and, though his feelings were doubtless excessive, there is no doubt that gloom was thrown over his life, intensified in 1867 by the loss of his son George Campbell De Morgan, a young man of the highest scientific promise, whose name, as De Morgan expressly wished, will long be connected with the London Mathematical Society, of which he was one of the founders. From this time De Morgan rapidly fell into ill-health, previously almost unknown to him, dying on the 18th of March 1871. An interesting and truthful sketch of his life will be found in the *Monthly Notices of the Royal Astronomical Society* for the 9th of February 1872, vol. xxii. p. 112, written by A. C. Ranyard, who says, "He was the kindliest, as well as the most learned of men—benignant to every one who approached him, never forgetting the claims which weakness has on strength."

De Morgan left no published indications of his opinions on religious questions, in regard to which he was extremely reticent. He seldom or never entered a place of worship, and declared that he could not listen to a sermon, a circumstance perhaps due to the extremely strict religious discipline under which he was brought up. Nevertheless there is reason to believe that he

was of a deeply religious disposition. Like M. Faraday and Sir I. Newton he entertained a confident belief in Providence, founded not on any tenuous inference, but on personal feeling. His hope of a future life also was vivid to the last.

It is impossible to omit a reference to his witty sayings, some specimens of which are preserved in Dr Sadler's most interesting *Diary of Henry Crabb Robinson* (1869), which also contains a humorous account of H. C. R. by De Morgan. It may be added that De Morgan was a great reader and admirer of Dickens; he was also fond of music, and a fair performer on the flute. (W. S. J.)

His son, WILLIAM FREND DE MORGAN (b. 1839), first became known in artistic circles as a potter, the "De Morgan" tiles being remarkable for his rediscovery of the secret of some beautiful colours and glazes. But later in life he became even better known to the literary world by his novels, *Joseph Vance* (1906), *Alice for Short* (1907), *Somehow Good* (1908) and *It Never Can Happen Again* (1909), in which the influence of Dickens and of his own earlier family life were conspicuous.

DEMOSTHENES, the great Attic orator and statesman, was born in 384 (or 383) B.C. His father, who bore the same name, was an Athenian citizen belonging to the deme of Paeania. His mother, Cleobule, was the daughter of Gylon, a citizen who had been active in procuring the protection of the kings of Bosporus for the Athenian colony of Nymphaeon in the Crimea, and whose wife was a native of that region. On these grounds the adversaries of Demosthenes, in after-days, used absurdly to taunt him with a traitorous or barbarian ancestry. The boy had a bitter foretaste of life. He was seven years old when his father died, leaving property (in a manufactory of swords, and another of upholstery) worth about £3500, which, invested as it seems to have been (20 % was not thought exorbitant), would have yielded rather more than £600 a year. £300 a year was a very comfortable income at Athens, and it was possible to live decently on a tenth of it. Nicias, a very rich man, had property equivalent, probably, to not more than £4000 a year. Demosthenes was born then, to a handsome, though not a great fortune. But his guardians—two nephews of his father, Aphobus and Demophon, and one Therippides—abused their trust, and handed over to Demosthenes, when he came of age, rather less than one-seventh of his patrimony, perhaps between £50 and £60 a year. Demosthenes, after studying with Isaeus (*q.v.*)—then the great master of forensic eloquence and of Attic law, especially in will cases[1]—brought an action against Aphobus, and gained a verdict for about £2400. But it does not appear that he got the money; and, after some more fruitless proceedings against Onetor, the brother-in-law of Aphobus, the matter was dropped,—not, however, before his relatives had managed to throw a public burden (the equipment of a ship of war) on their late ward, whereby his resources were yet further straitened. He now became a professional writer of speeches or pleas (λογογράφος) for the law courts, sometimes speaking himself. Biographers have delighted to relate how painfully Demosthenes made himself a tolerable speaker,—how, with pebbles in his mouth, he tried his lungs against the waves, how he declaimed as he ran up hill, how he shut himself up in a cell, having first guarded himself against a longing for the haunts of men by shaving one side of his head, how he wrote out Thucydides eight times, how he was derided by the Assembly and encouraged by a judicious actor who met him moping about the Peiraeus. He certainly seems to have been the reverse of athletic (the stalwart Aeschines upbraids him with never having been a sportsman), and he probably had some sort of defect or impediment in his speech as a boy. Perhaps the most interesting fact about his work for the law courts is that he seems to have continued it, in some measure, through the most exciting parts of his great political career. The speech for Phormio belongs to the same year as the plea for Megalopolis. The speech against Boeotus "Concerning the Name" comes between the First Philippic and the First Olynthiac. The speech against Pantaenetus comes between the speech "On the Peace" and the Second Philippic.

[1] See Jebb's *Attic Orators from Antiphon to Isaeos*, vol. ii. p. 267 f.

Political career and creed.

The political career of Demosthenes, from his first direct contact with public affairs in 355 B.C. to his death in 322, has an essential unity. It is the assertion, in successive forms adapted to successive moments, of unchanging principles. Externally, it is divided into the chapter which precedes and the chapter which follows Chaeronea. But its inner meaning, the secret of its indomitable vigour, the law which harmonizes its apparent contrasts, cannot be understood unless it is regarded as a whole. Still less can it be appreciated in all its large wisdom and sustained self-mastery if it is viewed merely as a duel between the ablest champion and the craftiest enemy of Greek freedom. The time indeed came when Demosthenes and Philip stood face to face as representative antagonists in a mortal conflict. But, for Demosthenes, the special peril represented by Philip, the peril of subjugation to Macedon, was merely a disastrous accident. Philip happened to become the most prominent and most formidable type of a danger which was already threatening Greece before his baleful star arose. As Demosthenes said to the Athenians, if the Macedonian had not existed, they would have made another Philip for themselves. Until Athens recovered something of its old spirit, there must ever be a great standing danger, not for Athens only, but for Greece,—the danger that sooner or later, in some shape, from some quarter—no man could foretell the hour, the manner or the source—barbarian violence would break up the gracious and undefiled tradition of separate Hellenic life.

What was the true relation of Athens to Greece? The answer which he gave to this question is the key to the life of Demosthenes. Athens, so Demosthenes held, was the natural head of Greece. Not, however, as an empress holding subject or subordinate cities in a dependence more or less compulsory. Rather as that city which most nobly expressed the noblest attributes of Greek political existence, and which, by her pre-eminent gifts both of intellect and of moral insight, was primarily responsible, everywhere and always, for the maintenance of those attributes in their integrity. Wherever the cry of the oppressed goes up from Greek against Greek, it was the voice of Athens which should first remind the oppressor that Hellene differed from barbarian in postponing the use of force to the persuasions of equal law. Wherever a barbarian hand offered wrong to any city of the Hellenic sisterhood, it was the arm of Athens which should first be stretched forth in the holy strength of Apollo the Averter. Wherever among her own children the ancient loyalty was yielding to love of pleasure or of base gain, there, above all, it was the duty of Athens to see that the central hearth of Hellas was kept pure. Athens must never again seek "empire" in the sense which became odious under the influence of Cleon and Hyperbolus,—when, to use the image of Aristophanes, the allies were as Babylonian slaves grinding in the Athenian mill. Athens must never permit, if she could help it, the re-establishment of such a domination as Sparta exercised in Greece from the battle of Aegospotami to the battle of Leuctra. Athens must aim at leading a free confederacy, of which the members should be bound to her by their own truest interests. Athens must seek to deserve the confidence of all Greeks alike.

Such, in the belief of Demosthenes, was the part which Athens must perform if Greece was to be safe. But reforms must be effected before Athens could be capable of such a part. The evils to be cured were different phases of one malady. Athens had long been suffering from the profound decay of public spirit. Since the early years of the Peloponnesian War, the separation of Athenian society from the state had been growing more and more marked. The old type of the eminent citizen, who was at once statesman and general, had become almost extinct. Politics were now managed by a small circle of politicians. Wars were conducted by professional soldiers whose troops were chiefly mercenaries, and who were usually regarded by the politicians either as instruments or as enemies. The mass of the citizens took no active interest in public affairs. But, though indifferent to principles, they had quickly sensitive partialities for men, and it was necessary to keep them in good humour. Pericles had introduced the practice of giving a

Theoric fund.

small bounty from the treasury to the poorer citizens, for the purpose of enabling them to attend the theatre at the great festivals —in other words, for the purpose of bringing them under the concentrated influence of the best Attic culture. A provision eminently wise for the age of Pericles easily became a mischief when the once honourable name of "demagogue" began to mean a flatterer of the mob. Before the end of the Peloponnesian War the festival-money (*theoricon*) was abolished. A few years after the restoration of the democracy it was again introduced. But until 354 B.C. it had never been more than a gratuity, of which the payment depended on the treasury having a surplus. In 354 B.C. Eubulus became steward of the treasury. He was an able man, with a special talent for finance, free from all taint of personal corruption, and sincerely solicitous for the honour of Athens, but enslaved to popularity, and without principles of policy. His first measure was to make the festival-money a permanent item in the budget. Thenceforth this bounty was in reality very much what Demades afterwards called it,—the cement (κόλλα) of the democracy.

Years before the danger from Macedon was urgent, Demosthenes had begun the work of his life,—the effort to lift the spirit of Athens, to revive the old civic loyalty, to rouse the city into taking that place and performing that part which her own welfare as well as the safety of Greece prescribed. His formally political speeches must never be considered apart from his forensic speeches in public causes. The Athenian procedure against the proposer of an unconstitutional law—*i.e.* of a law incompatible with existing laws—had a direct tendency to make the law court, in such cases, a political arena. The same tendency was indirectly exerted by the tolerance of Athenian juries (in the absence of a presiding expert like a judge) for irrelevant matter, since it was usually easy for a speaker to make capital out of the adversary's political antecedents. But the forensic speeches of Demosthenes for public causes are not only political in this general sense. They are documents, as indispensable as the Olynthiacs or Philippics, for his own political career. Only by taking them along with the formally political speeches, and regarding the whole as one unbroken series, can we see clearly the full scope of the task which he set before him,—a task in which his long resistance to Philip was only the most dramatic incident, and in which his real achievement is not to be measured by the event of Chaeronea.

Forensic speeches in public causes.

A forensic speech, composed for a public cause, opens the political career of Demosthenes with a protest against a signal abuse. In 355 B.C., at the age of twenty-nine, he wrote the speech "Against Androtion." This combats on legal grounds a proposal that the out-going senate should receive the honour of a golden crown. In its larger aspect, it is a denunciation of the corrupt system which that senate represented, and especially of the manner in which the treasury had been administered by Aristophon. In 354 B.C. Demosthenes composed and spoke the oration "Against Leptines," who had effected a slender saving for the state by the expedient of revoking those hereditary exemptions from taxation which had at various times been conferred in recognition of distinguished merit. The descendants of Harmodius and Aristogeiton alone had been excepted from the operation of the law. This was the first time that the voice of Demosthenes himself had been heard on the public concerns of Athens, and the utterance was a worthy prelude to the career of a statesman. He answers the advocates of the retrenchment by pointing out that the public interest will not ultimately be served by a wholesale violation of the public faith. In the same year he delivered his first strictly political speech, "On the Navy Boards" (Symmories). The Athenians, irritated by the support which Artaxerxes had lately given to the revolt of their allies, and excited by rumours of his hostile preparations, were feverishly eager for a war with Persia. Demosthenes urges that such an enterprise would at present be useless; that it would fail to unite Greece; that the energies of the city should be reserved for a real emergency; but that, before the city can successfully cope with any war, there must be a better organization of resources, and, first of all, a reform of the navy, which he outlines with characteristic lucidity and precision.

Two years later (352 B.C.) he is found dealing with a more definite question of foreign policy. Sparta, favoured by the depression of Thebes in the Phocian War, was threatening Megalopolis. Both Sparta and Megalopolis sent embassies to Athens. Demosthenes supported Megalopolis. The ruin of Megalopolis would mean, he argued, the return of Spartan domination in the Peloponnesus. Athenians must not favour the tyranny of any one city. They must respect the rights of all the cities, and thus promote unity based on mutual confidence. In the same year Demosthenes wrote the speech "Against Timocrates," to be spoken by the same Diodorus who had before prosecuted Androtion, and who now combated an attempt to screen Androtion and others from the penalties of embezzlement. The speech "Against Aristocrates," also of 352 B.C., reproves that foreign policy of feeble makeshifts which was now popular at Athens. The Athenian tenure of the Thracian Chersonese partly depended for its security on the good-will of the Thracian prince Cersobleptes. Charidemus, a soldier of fortune who had already played Athens false, was now the brother-in-law and the favourite of Cersobleptes. Aristocrates proposed that the person of Charidemus should be invested with a special sanctity, by the enactment that whoever attempted his life should be an outlaw from all dominions of Athens. Demosthenes points out that such adulation is as futile as it is fulsome. Athens can secure the permanence of her foreign possessions only in one way—by being strong enough to hold them.

Thus, between 355 and 352, Demosthenes had laid down the main lines of his policy. Domestic administration must be purified. Statesmen must be made to feel that they are responsible to the state. They must not be allowed to anticipate judgment on their deserts by voting each other golden crowns. They must not think to screen misappropriation of public money by getting partisans to pass new laws about state-debtors. Foreign policy must be guided by a larger and more provident conception of Athenian interests. When public excitement demands a foreign war, Athens must not rush into it without asking whether it is necessary, whether it will have Greek support, and whether she herself is ready for it. When a strong Greek city threatens a weak one, and seeks to purchase Athenian connivance with the bribe of a border-town, Athens must remember that duty and prudence alike command her to respect the independence of all Greeks. When it is proposed, by way of insurance on Athenian possessions abroad, to flatter the favourite of a doubtful ally, Athens must remember that such devices will not avail a power which has no army except on paper, and no ships fit to leave their moorings.

Principles of policy.

But the time had gone by when Athenians could have tranquil leisure for domestic reform. A danger, calling for prompt action, had at last come very near. For six years Athens had been at war with Philip on account of his seizure of Amphipolis. Meanwhile he had destroyed Potidaea and founded Philippi. On the Thracian coasts he had become master of Abdera and Maronea. On the Thessalian coast he had acquired Methone. In a second invasion of Thessaly, he had overthrown the Phocians under Onomarchus, and had advanced to Thermopylae, to find the gates of Greece closed against him by an Athenian force. He had then marched to Heraeon on the Propontis, and had dictated a peace to Cersobleptes. He had formed an alliance with Cardia, Perinthus and Byzantium. Lastly, he had begun to show designs on the great Confederacy of Olynthus, the more warlike Miletus of the North. The First Philippic of Demosthenes was spoken in 351 B.C. The Third Philippic—the latest of the extant political speeches—was spoken in 341 B.C. Between these he delivered eight political orations, of which seven are directly concerned with Philip. The whole series falls into two great divisions. The first division comprises those speeches which were spoken against Philip while he was still a foreign power threatening Greece from without. Such are the First Philippic and the three orations for Olynthus. The second division comprises the speeches

Athens and Philip.

spoken against Philip when, by admission to the Amphictyonic Council, he had now won his way within the circle of the Greek states, and when the issue was no longer between Greece and Macedonia, but between the Greek and Macedonian parties in Greece. Such are the speech "On the Peace," the speech "On the Embassy," the speech "On the Chersonese," the Second and Third Philippics.

The First Philippic, spoken early in 351 B.C., was no sudden note of alarm drawing attention to an unnoticed peril. On the contrary, the Assembly was weary of the subject. For six years the war with Philip had been a theme of barren talk. Demosthenes urges that it is time to do something, and to do it with a plan. Athens fighting Philip has fared, he says, like an amateur boxer opposed to a skilled pugilist. The helpless hands have only followed blows which a trained eye should have taught them to parry. An Athenian force must be stationed in the north, at Lemnos or Thasos. Of 2000 infantry and 200 cavalry at least one quarter must be Athenian citizens capable of directing the mercenaries.

First Philippic.

Later in the same year Demosthenes did another service to the cause of national freedom. Rhodes, severed by its own act from the Athenian Confederacy, had since 355 been virtually subject to Mausolus, prince (*δυνάστης*) of Caria, himself a tributary of Persia. Mausolus died in 351, and was succeeded by his widow Artemisia. The democratic party in Rhodes now appealed to Athens for help in throwing off the Carian yoke. Demosthenes supported their application in his speech "For the Rhodians." No act of his life was a truer proof of statesmanship. He failed. But at least he had once more warned Athens that the cause of political freedom was everywhere her own, and that, wherever that cause was forsaken, there a new danger was created both for Athens and for Greece.

Next year (350) an Athenian force under Phocion was sent to Euboea, in support of Plutarchus, tyrant of Eretria, against the faction of Cleitarchus. Demosthenes protested against spending strength, needed for greater objects, on the local quarrels of a despot. Phocion won a victory at Tamynae. But the "inglorious and costly war" entailed an outlay of more than £12,000 on the ransom of captives alone, and ended in the total destruction of Athenian influence throughout Euboea. That island was now left an open field for the intrigues of Phi[illegible]. Worst of all, the party of Eubulus not only defeated a proposal, arising from this campaign, for applying the festival-money to the war-fund, but actually carried a law making it high treason to renew the proposal. The degree to which political enmity was exasperated by the Euboean War may be judged from the incident of Midias, an adherent of Eubulus, and a type of opulent rowdyism. Demosthenes was choragus of his tribe, and was wearing the robe of that sacred office at the great festival in the theatre of Dionysus, when Midias struck him on the face. The affair was eventually compromised. The speech "Against Midias" written by Demosthenes for the trial (in 349) was neither spoken nor completed, and remains, as few will regret, a sketch.

Euboean War.

It was now three years since, in 352, the Olynthians had sent an embassy to Athens, and had made peace with their only sure ally. In 350 a second Olynthian embassy had sought and obtained Athenian help. The hour of Olynthus had indeed come. In 349 Philip opened war against the Chalcidic towns of the Olynthian League. The First and Second Olynthiacs of Demosthenes were spoken in that year in support of sending one force to defend Olynthus and another to attack Philip. "Better now than later," is the thought of the First Olynthiac. The Second argues that Philip's strength is overrated. The Third—spoken in 348—carries us into the midst of action.[1] It deals with practical details. The festival-fund must be used for the war. The citizens must serve in person.

Olynthiacs.

[1] It is generally agreed that the Third Olynthiac is the latest; but the question of the order of the First and Second has been much discussed. See Grote (*History of Greece*, chap. 88, appendix), who prefers the arrangement u. t. m., and Blass, *Die attische Beredsamkeit*, iii. p. 319.

A few months later, Olynthus and the thirty-two towns of the confederacy were swept from the earth. Men could walk over their sites, Demosthenes said seven years afterwards, without knowing that such cities had existed. It was now certain that Philip could not be stopped outside of Greece. The question was, What point within Greece shall he be allowed to reach?

Eubulus and his party, with that versatility which is the privilege of political vagueness, now began to call for a congress of the allies to consider the common danger. They found a brilliant interpreter in Aeschines, who, after having been a tragic actor and a clerk to the assembly, had entered political life with the advantages of a splendid gift for eloquence, a fine presence, a happy address, a ready wit and a facile conscience. While his opponents had thus suddenly become warlike, Demosthenes had become pacific. He saw that Athens must have time to collect strength. Nothing could be gained, meanwhile, by going on with the war. Macedonian sympathizers at Athens, of whom Philocrates was the chief, also favoured peace. Eleven envoys, including Philocrates, Aeschines, and Demosthenes, were sent to Philip in February 346 B.C. After a debate at Athens, peace was concluded with Philip in April. Philip on the one hand, Athens and her allies on the other, were to keep what they respectively held at the time when the peace was ratified. But here the Athenians made a fatal error. Philip was bent on keeping the door of Greece open. Demosthenes was bent on shutting it against him. Philip was now at war with the people of Halus in Thessaly. Thebes had for ten years been at war with Phocis. Here were two distinct chances for Philip's armed intervention in Greece. But if the Halians and the Phocians were included in the peace, Philip could not bear arms against them without violating the peace. Accordingly Philip insisted that they should not be included. Demosthenes insisted they should be included. They were not included. The result followed speedily. The same envoys were sent a second time to Philip at the end of April 346 for the purpose of receiving his oaths in ratification of the peace. It was late in June before he returned from Thrace to Pella—thus gaining, under the terms, all the towns that he had taken meanwhile. He next took the envoys with him through Thessaly to Thermopylae. There—at the invitation of Thessalians and Thebans—he intervened in the Phocian War. Phalaecus surrendered. Phocis was crushed. Philip took its place in the Amphictyonic Council, and was thus established as a Greek power in the very centre, at the sacred hearth, of Greece. The right of precedence in consultation of the oracle (*προμαντεία*) was transferred from Athens to Philip. While indignant Athenians were clamouring for the revocation of the peace, Demosthenes upheld it in his speech "On the Peace" in September. It ought never to have been made on such terms, he said. But, having been made, it had better be kept. "If we went to war now, where should we find allies? And after losing Oropus, Amphipolis, Cardia, Chios, Cos, Rhodes, Byzantium, shall we fight about the shadow of Delphi?"

Peace between Philip and Athens.

End of Phocian War.

During the eight years between the peace of Philocrates and the battle of Chaeronea, the authority of Demosthenes steadily grew, until it became first predominant and then paramount. He had, indeed, a melancholy advantage. Each year his argument was more and more cogently enforced by the logic of facts. In 344 he visited the Peloponnesus for the purpose of counteracting Macedonian intrigue. Mistrust, he told the Peloponnesian cities, is the safeguard of free communities against tyrants. Philip lodged a formal complaint at Athens. Here, as elsewhere, the future master of Greece reminds us of Napoleon on the eve of the first empire. He has the same imperturbable and persuasive effrontery in protesting that he is doing one thing at the moment when his energies are concentrated on doing the opposite. Demosthenes replied in the Second Philippic. "If," he said, "Philip is the friend of Greece, we are doing wrong. If he is the enemy of Greece, we are doing right. Which is he? I hold him to be our enemy, because everything that he has hitherto done has benefited himself and hurt us." The prosecution of Aeschines for malversation on the

Second Philippic

embassy (commonly known as *De falsa legatione*), which was brought to an issue in the following year, marks the moral strength of the position now held by Demosthenes. When the gravity of the charge and the complexity of the evidence are considered, the acquittal of Aeschines by a narrow majority must be deemed his condemnation. The speech "On the Affairs of the Chersonese" and the Third Philippic were the crowning efforts of Demosthenes. Spoken in the same year, 341 B.C., and within a short space of each other, they must be taken together. The speech "On the Affairs of the Chersonese" regards the situation chiefly from an Athenian point of view. "If the peace means," argues Demosthenes, "that Philip can seize with impunity one Athenian possession after another, but that Athenians shall not on their peril touch aught that belongs to Philip, where is the line to be drawn? We shall go to war, I am told, when it is necessary. If the necessity has not come yet, when will it come?" The Third Philippic surveys a wider horizon. It ascends from the Athenian to the Hellenic view. Philip has annihilated Olynthus and the Chalcidic towns. He has ruined Phocis. He has frightened Thebes. He has divided Thessaly. Euboea and the Peloponnesus are his. His power stretches from the Adriatic to the Hellespont. Where shall be the end? Athens is the last hope of Greece. And, in this final crisis, Demosthenes was the embodied energy of Athens. It was Demosthenes who went to Byzantium, brought the estranged city back to the Athenian alliance, and snatched it from the hands of Philip. It was Demosthenes who, when Philip had already seized Elatea, hurried to Thebes, who by his passionate appeal gained one last chance, the only possible chance, for Greek freedom, who broke down the barrier of an inveterate jealousy, who brought Thebans to fight beside Athenians, and who thus won at the eleventh hour a victory for the spirit of loyal union which took away at least one bitterness from the unspeakable calamity of Chaeronea.

Third Philippic.

But the work of Demosthenes was not closed by the ruin of his cause. During the last sixteen years of his life (338–322) he rendered services to Athens not less important, and perhaps more difficult, than those which he had rendered before. He was now, as a matter of course, foremost in the public affairs of Athens. In January 337, at the annual winter Festival of the Dead in the Outer Ceramicus, he spoke the funeral oration over those who had fallen at Chaeronea. He was member of a commission for strengthening the fortifications of the city (τειχοποιός). He administered the festival-fund. During a dearth which visited Athens between 330 and 326 he was charged with the organization of public relief. In 324 he was chief (ἀρχιθέωρος) of the sacred embassy to Olympia. Already, in 336, Ctesiphon had proposed that Demosthenes should receive a golden crown from the state, and that his extraordinary merits should be proclaimed in the theatre at the Great Dionysia. The proposal was adopted by the senate as a bill (προβούλευμα): but it must be passed by the Assembly before it could become an act (ψήφισμα). To prevent this, Aeschines gave notice, in 336, that he intended to proceed against Ctesiphon for having proposed an unconstitutional measure. For six years Aeschines avoided action on this notice. At last, in 330, the patriotic party felt strong enough to force him to an issue. Aeschines spoke the speech "Against Ctesiphon," an attack on the whole public life of Demosthenes. Demosthenes gained an overwhelming victory for himself and for the honour of Athens in the most finished, the most splendid and the most pathetic work of ancient eloquence — the immortal oration "On the Crown."

Municipal activity.

In the winter of 325–324 Harpalus, the receiver-general of Alexander in Asia, fled to Greece, taking with him 8000 mercenaries, and treasure equivalent to about a million and a quarter sterling. On the motion of Demosthenes he was warned from the harbours of Attica. Having left his troops and part of his treasure at Taenarum, he again presented himself at the Peiraeus, and was now admitted. He spoke fervently of the opportunity which offered itself to those who loved the freedom of Greece. All Asia would rise with Athens to throw off the hated yoke. Fiery patriots like Hypereides were in raptures. For zeal which could be bought Harpalus had other persuasions. But Demosthenes stood firm. War with Alexander would, he saw, be madness. It could have but one result,—some indefinitely worse doom for Athens. Antipater and Olympias presently demanded the surrender of Harpalus. Demosthenes opposed this. But he reconciled the dignity with the loyalty of Athens by carrying a decree that Harpalus should be arrested, and that his treasure should be deposited in the Parthenon, to be held in trust for Alexander. Harpalus escaped from prison. The amount of the treasure, which Harpalus had stated as 700 talents, proved to be no more than 350. Demosthenes proposed that the Areopagus should inquire what had become of the other 350. Six months, spent in party intrigues, passed before the Areopagus gave in their report (ἀπόφασις). The report inculpated nine persons. Demosthenes headed the list of the accused. Hypereides was among the ten public prosecutors. Demosthenes was condemned, fined fifty talents, and, in default of payment, imprisoned. After a few days he escaped from prison to Aegina, and thence to Troezen. Two things in this obscure affair are beyond reasonable doubt. First, that Demosthenes was not bribed by Harpalus. The hatred of the Macedonian party towards Demosthenes, and the fury of those vehement patriots who cried out that he had betrayed their best opportunity, combined to procure his condemnation, with the help, probably, of some appearances which were against him. Secondly, it can hardly be questioned that, by withstanding the hot-headed patriots at this juncture, Demosthenes did heroic service to Athens.

Affair of Harpalus.

Next year (323 B.C.) Alexander died. Then the voice of Demosthenes, calling Greece to arms, rang out like a trumpet. Early in August 322 the battle of Crannon decided the Lamian War against Greece. Antipater demanded, as the condition on which he would refrain from besieging Athens, the surrender of the leading patriots. Demades moved the decree of the Assembly by which Demosthenes, Hypereides, and some others were condemned to death as traitors. On the 20th of Boedromion (September 16) 322, a Macedonian garrison occupied Munychia. It was a day of solemn and happy memories, a day devoted, in the celebration of the Great Mysteries, to sacred joy,—the day on which the glad procession of the Initiated returned from Eleusis to Athens. It happened, however, to have another association, more significant than any ironical contrast for the present purpose of Antipater. It was the day on which, thirteen years before, Alexander had punished the rebellion of Thebes with annihilation.

End of Lamian War.

Demosthenes condemned.

The condemned men had fled to Aegina. Parting there from Hypereides and the rest, Demosthenes went on to Calauria, a small island off the coast of Argolis. In Calauria there was an ancient temple of Poseidon, once a centre of Minyan and Ionian worship, and surrounded with a peculiar sanctity as having been, from time immemorial, an inviolable refuge for the pursued. Here Demosthenes sought asylum. Archias of Thurii, a man who, like Aeschines, had begun life as a tragic actor, and who was now in the pay of Antipater, soon traced the fugitive, landed in Calauria, and appeared before the temple of Poseidon with a body of Thracian spearmen. Plutarch's picturesque narrative bears the marks of artistic elaboration. Demosthenes had dreamed the night before that he and Archias were competing for a prize as tragic actors; the house applauded Demosthenes; but his chorus was shabbily equipped, and Archias gained the prize. Archias was not the man to stick at sacrilege. In Aegina, Hypereides and the others had been taken from the shrine of Aeacus. But he hesitated to violate an asylum so peculiarly sacred as the Calaurian temple. Standing before its open door, with his Thracian soldiers around him, he endeavoured to prevail on Demosthenes to quit the holy precinct. Antipater would be certain to pardon him. Demosthenes sat silent, with his eyes fixed on the ground. At last, as the emissary persisted in his bland persuasions, he looked up and said,—"Archias, you never moved me by your acting, and you

Flight to Calauria.

will not move me now by your promises." Archias lost his temper, and began to threaten. "Now," rejoined Demosthenes, "you speak like a real Macedonian oracle; before you were acting. Wait a moment, then, till I write to my friends." With these words, Demosthenes withdrew into the inner part of the temple, — still visible, however, from the entrance. He took out a roll of paper, as if he were going to write, put the pen to his mouth, and bit it, as was his habit in composing. Then he threw his head back, and drew his cloak over it. The Thracian spearmen, who were watching him from the door, began to gibe at his cowardice.

Death. Archias went in to him, encouraged him to rise, repeated his old arguments, talked to him of reconciliation with Antipater. By this time Demosthenes felt that the poison which he had sucked from the pen was beginning to work. He drew the cloak from his face, and looked steadily at Archias. "Now you can play the part of Creon in the tragedy as soon as you like," he said, "and cast forth my body unburied. But I, O gracious Poseidon, quit thy temple while I yet live; Antipater and his Macedonians have done what they could to pollute it." He moved towards the door, calling to them to support his tottering steps. He had just passed the altar of the god, when he fell, and with a groan gave up the ghost (October 322 B.C.).

Political character. As a statesman, Demosthenes needs no epitaph but his own words in the speech "On the Crown,"—*I say that, if the event had been manifest to the whole world beforehand, not even then ought Athens to have forsaken this course, if Athens had any regard for her glory, or for her past, or for the ages to come.* The Persian soldier in Herodotus, following Xerxes to foreseen ruin, confides to his fellow-guest at the banquet that the bitterest pain which man can know is *πολλὰ φρονέοντα μηδενὸς κρατέειν*, complete, but helpless, prescience. In the grasp of a more inexorable necessity, the champion of Greek freedom was borne onward to a more tremendous catastrophe than that which strewed the waters of Salamis with Persian wrecks and the field of Plataea with Persian dead; but to him, at least, it was given to proclaim aloud the clear and sure foreboding that filled his soul, to do all that true heart and free hand could do for his cause, and, though not to save, yet to encourage, to console and to ennoble. As the inspiration of his life was larger and higher than the mere courage of resistance, so his merit must be regarded as standing altogether outside and above the struggle with Macedon. The great purpose which he set before him was to revive the public spirit, to restore the political vigour, and to re-establish the Panhellenic influence of Athens,—never for her own advantage merely, but always in the interest of Greece. His glory is, that while he lived he helped Athens to live a higher life. Wherever the noblest expressions of her mind are honoured, wherever the large conceptions of Pericles command the admiration of statesmen, wherever the architect and the sculptor love to dwell on the masterpieces of Ictinus and Pheidias, wherever the spell of ideal beauty or of lofty contemplation is exercised by the creations of Sophocles or of Plato, there it will be remembered that the spirit which wrought in all these would have passed sooner from among men, if it had not been recalled from a trance, which others were content to mistake for the last sleep, by the passionate breath of Demosthenes.

Oratory. The orator in whom artistic genius was united, more perfectly than in any other man, with moral enthusiasm and with intellectual grasp, has held in the modern world the same rank which was accorded to him in the old; but he cannot enjoy the same appreciation. Macaulay's ridicule has rescued from oblivion the criticism which pronounced the eloquence of Chatham to be more ornate than that of Demosthenes, and less diffuse than that of Cicero. Did the critic, asks Macaulay, ever hear any speaking that was less ornamented than that of Demosthenes, or more diffuse than that of Cicero? Yet the critic's remark was not so pointless as Macaulay thought it. Sincerity and intensity are, indeed, to the modern reader, the most obvious characteristics of Demosthenes. His style is, on the whole, singularly free from what we are accustomed to regard as rhetorical embellishment. Where the modern orator would employ a wealth of imagery, or elaborate a picture in exquisite detail, Demosthenes is content with a phrase or a word. Burke uses, in reference to Hyder Ali, the same image which Demosthenes uses in reference to Philip. "Compounding all the materials of fury, havoc, desolation, into one black cloud, he hung for a while on the declivity of the mountains. Whilst the authors of all these evils were idly and stupidly gazing on this menacing meteor, which darkened all their horizon, it suddenly burst, and poured down the whole of its contents upon the plains of the Carnatic." Demosthenes forbears to amplify. "The people gave their voice, and the danger which hung upon our borders went by like a cloud." To our modern feeling, the eloquence of Demosthenes exhibits everywhere a general stamp of earnest and simple strength. But it is well to remember the charge made against the style of Demosthenes by a contemporary Greek orator, and the defence offered by the best Greek critic of oratory. Aeschines reproached the diction of Demosthenes with excess of elaboration and adornment (*περιεργία*). Dionysius, in reply, admits that Demosthenes does at times depart from simplicity,—that his style is sometimes elaborately ornate and remote from the ordinary usage. But, he adds, Demosthenes adopts this manner where it is justified by the elevation of his theme. The remark may serve to remind us of our modern disadvantage for a full appreciation of Demosthenes. The old world felt, as we do, his moral and mental greatness, his fire, his self-devotion, his insight. But it felt also, as we can never feel, the versatile perfection of his skill. This it was that made Demosthenes unique to the ancients. The ardent patriot, the far-seeing statesman, were united in his person with the consummate and unapproachable artist. Dionysius devoted two special treatises to Demosthenes,—one on his language and style (*λεκτικὸς τόπος*), the other on his treatment of subject-matter (*πραγματικὸς τόπος*). The latter is lost. The former is one of the best essays in literary criticism which antiquity has bequeathed to us. The idea which it works out is that Demosthenes has perfected Greek prose by fusing in a glorious harmony the elements which had hitherto belonged to separate types. The austere dignity of Antiphon, the plain elegance of Lysias, the smooth and balanced finish of that middle or normal character which is represented by Isocrates, have come together in Demosthenes. Nor is this all. In each species he excels the specialists. He surpasses the school of Antiphon in perspicuity, the school of Lysias in verve, the school of Isocrates in variety, in felicity, in symmetry, in pathos, in power. Demosthenes has at command all the discursive brilliancy which fascinates a festal audience. He has that power of concise and lucid narration, of terse reasoning, of persuasive appeal, which is required by the forensic speaker. His political eloquence can worthily image the majesty of the state, and enforce weighty counsels with lofty and impassioned fervour. A true artist, he grudged no labour which could make the least part of his work more perfect. Isocrates spent ten years on the *Panegyricus*. After Plato's death, a manuscript was found among his papers with the first eight words of the *Republic* arranged in several different orders. What wonder, then, asks the Greek critic, if the diligence of Demosthenes was no less incessant and minute? "To me," he says, "it seems far more natural that a man engaged in composing political discourses, imperishable memorials of his power, should neglect not even the smallest details, than that the veneration of painters and sculptors, who are darkly showing forth their manual tact and toil in a corruptible material, should exhaust the refinements of their art on the veins, on the feathers, on the down of the lip, and the like niceties."

Works. More than half of the sixty-one speeches extant under the name of Demosthenes are certainly or probably spurious. The results to which the preponderance of opinion leans are given in the following table. Those marked *a* were already rejected or doubted in antiquity; those marked *m*, first in modern times:[1]

[1] The dates agree in the main with those given by A. D. Schäfer in *Demosthenes und seine Zeit* (2nd ed., 1885–1887), and by F. Blass in *Die attische Beredsamkeit* (1887–1898), who regards thirty-three (or possibly thirty-five) of the speeches as genuine.

I. DELIBERATIVE SPEECHES.

Genuine.

	Or. 14.	On the Navy Boards	354	B.C.
	Or. 16.	For the People of Megalopolis	352	,,
	Or. 4.	First Philippic	351	,,
	Or 15.	For the Rhodians	351	,,
	Or. 1.	First Olynthiac	349	,,
	Or. 2.	Second Olynthiac	349	,,
	Or. 3.	Third Olynthiac	348	,,
	Or. 5.	On the Peace	346	,,
	Or. 6.	Second Philippic	344	,,
	Or. 8.	On the Affairs of the Chersonese	341	,,
	Or. 9.	Third Philippic	341	,,

Spurious.

(*a*)	Or. 7.	On Halonnesus (by Hegesippus)	342	B.C.

Rhetorical Forgeries.

(*a*)	Or. 17.	On the Treaty with Alexander.
(*a*)	Or. 10.	Fourth Philippic.
(*m*)	Or. 11.	Answer to Philip's Letter.[1]
(*m*)	Or. 12.	Philip's Letter.
(*m*)	Or. 13.	On the Assessment (*σύνταξις*).

II. FORENSIC SPEECHES.

A. In Public Causes.

Genuine.

	Or. 22.	In (*κατά*) Androtionem	355	B.C.
	Or. 20.	Contra (*πρός*) Leptinem	354	,,
	Or. 24.	In Timocratem	352	,,
	Or. 23.	In Aristocratem	352	,,
	Or. 21.	In Midiam	349	,,
	Or. 19.	On the Embassy	343	,,
	Or. 18.	On the Crown	330	,,

Spurious.

(*a*)	Or. 58.	In Theocrinem	339	B.C.
(*a*)	Or. 25, 26.	In Aristogitona I. and II. (Rhetorical forgeries).		

B. In Private Causes.

Genuine.

	Or. 27, 28.	In Aphobum I. et II.	364	B.C.
(*m*)	Or. 30, 31.	Contra Onetora I. et II	362	,,
	Or. 41.	Contra Spudiam	?	
(*m*)	Or. 55.	Contra Calliclem	?	
	Or. 54.	In Cononem	356	,,
	Or. 36.	Pro Phormione	352	,,
(*m*)	Or. 39.	Contra Boeotum de Nomine	350	,,
	Or. 37.	Contra Pantaenetum	346–5	,,
(*m*)	Or. 38.	Contra Nausimachum et Diopithem	?	

Spurious.

(*The first eight of the following are given by Schäfer to Apollodorus.*)

(*m*)	Or. 52.	Contra Callippum	369–8	B.C.
(*a*)	Or. 53.	Contra Nicostratum	after 368	,,
(*a*)	Or. 49.	Contra Timotheum	362	,,
(*m*)	Or. 50.	Contra Polyclem	357	,,
(*a*)	Or. 47.	In Evergum et Mnesibulum	356	,,
(*m*)	Or. 45, 46.	In Stephanum I. et II.	351	,,
(*a*)	Or. 59.	In Neaeram	349 [343–0, Blass]	,,
(*m*)	Or. 51.	On the Trierarchic Crown (by Cephisodotus ?)	360–359	,,
(*m*)	Or. 43.	Contra Macartatum	?	
(*m*)	Or. 48.	In Olympiodorum	after 343	,,
(*m*)	Or. 44.	Contra Leocharem	?	
(*a*)	Or. 35.	Contra Lacritum	341	,,
(*a*)	Or. 42.	Contra Phaenippum	?	
(*m*)	Or. 32.	Contra Zenothemin	?	
(*m*)	Or. 34.	Contra Phormionem	?	
(*m*)	Or. 29.	Contra Aphobum pro Phano		
(*a*)	Or. 40.	Contra Boeotum de Dote	347	,,
(*m*)	Or. 57.	Contra Eubulidem	346–5	,,
(*m*)	Or 33.	Contra Apaturium	?	
(*a*)	Or. 56.	In Dionysodorum	not before 322–1	,,

Or. 60 (*ἐπιτάφιος*) and Or. 61 (*ἐρωτικός*) are works of rhetoricians. The six epistles are also forgeries; they were used by the composer of the twelve epistles which bear the name of Aeschines. The 56 *προοίμια*, exordia or sketches for political speeches, are by various hands and of various dates.[2] They are valuable as being compiled from Demosthenes himself, or from other classical models.

The ancient fame of Demosthenes as an orator can be compared only with the fame of Homer as a poet. Cicero, with generous appreciation, recognizes Demosthenes as the standard of perfection. Dionysius, the closest and most penetrating of his ancient critics, exhausts the language of admiration in showing how Demosthenes united and elevated whatever had been best in earlier masters of the Greek idiom. Hermogenes, in his works on rhetoric, refers to Demosthenes as ὁ *ῥήτωρ*, *the orator*. The writer of the treatise On Sublimity knows no heights loftier than those to which Demosthenes has risen. From his own younger contemporaries, Aristotle and Theophrastus, who founded their theory of rhetoric in large part on his practice, down to the latest Byzantines, the consent of theorists, orators, antiquarians, anthologists, lexicographers, offered the same unvarying homage to Demosthenes. His work busied commentators such as Xenon, Minucian, Basilicus, Aelius, Theon, Zosimus of Gaza. Arguments to his speeches were drawn up by rhetoricians so distinguished as Numenius and Libanius. Accomplished men of letters, such as Julius Vestinus and Aelius Dionysius, selected from his writings choice passages for declamation or perusal, of which fragments are incorporated in the miscellany of Photius and the lexicons of Harpocration, Pollux and Suidas. It might have been anticipated that the purity of a text so widely read and so renowned would, from the earliest times, have been guarded with jealous care. The works of the three great dramatists had been thus protected, about 340 B.C., by a standard Attic recension. But no such good fortune befell the works of Demosthenes. Alexandrian criticism was chiefly occupied with poetry. The titular works of Demosthenes were, indeed, registered, with those of the other orators, in the catalogues (*ῥητορικοὶ πίνακες*) of Alexandria and Pergamum. But no thorough attempt was made to separate the authentic works from those spurious works which had even then become mingled with them. Philosophical schools which, like the Stoic, felt the ethical interest of Demosthenes, cared little for his language. The rhetoricians who imitated or analysed his style cared little for the criticism of his text. Their treatment of it had, indeed, a direct tendency to falsify it. It was customary to indicate by marks those passages which were especially useful for study or imitation. It then became a rhetorical exercise to recast, adapt or interweave such passages. Sopater, the commentator on Hermogenes, wrote on *μεταβολαὶ καὶ μεταποιήσεις τῶν Δημοσθένους χωρίων*, "adaptations or transcripts of passages in Demosthenes." Such manipulation could not but lead to interpolations or confusions in the original text. Great, too, as was the attention bestowed on the thought, sentiment and style of Demosthenes, comparatively little care was bestowed on his subject-matter. He was studied more on the moral and the formal side than on the real side. An incorrect substitution of one name for another, a reading which gave an impossible date, insertions of spurious laws or decrees, were points which few readers would stop to notice. Hence it resulted that, while Plato, Thucydides and Demosthenes were the most universally popular of the classical prose-writers, the text of Demosthenes, the most widely used perhaps of all, was also the least pure. His more careful students at length made an effort to arrest the process of corruption. Editions of Demosthenes based on a critical recension, and called Ἀττικιανί (*ἀντίγραφα*), came to be distinguished from the vulgates, or *δημώδεις ἐκδόσεις*.

Literary history of Demosthenes.

Among the extant manuscripts of Demosthenes—upwards of 170 in number—one is far superior, as a whole, to the rest. This is *Parisinus* Σ 2934, of the 10th century. A comparison of this MS. with the extracts of Aelius, Aristeides and Harpocration from the Third Philippic favours the view that it is derived from an Ἀττικιανόν, whereas the *δημώδεις ἐκδόσεις*, used by Hermogenes and by the rhetoricians generally, have been the chief sources of our other manuscripts. The collation of this manuscript by Immanuel Bekker first placed the textual criticism of Demosthenes on a sound footing. Not only is this manuscript nearly free from interpolations, but it is the sole voucher for many excellent readings. Among the other MSS., some of the most important are—*Marcianus* 416 F, of the 10th (or 11th) century, the basis of the Aldine edition; *Augustanus* I. (N 85), derived from the last, and containing scholia to the speeches on the Crown and the Embassy, by Ulpian, with some by a younger writer, who was

Manuscripts.

[1] Or. 11 and 12 are probably both by Anaximenes of Lampsacus.

[2] According to Blass, the second and third epistles and the *exordia* are genuine.

perhaps Moschopulus; *Parisinus* Υ; *Antverpiensis* Ω—the last two comparatively free from additions. The fullest authority on the MSS. is J. T. Vömel, *Notitia codicum Demosth.*, and Prolegomena Critica to his edition published at Halle (1856–1857), pp. 175-178.[1]

Scholia. The extant scholia on Demosthenes are for the most part poor. Their staple consists of Byzantine erudition; and their value depends chiefly on what they have preserved of older criticism. They are better than usual for the Περὶ στεφάνου, Κατὰ Τιμοκράτους; best for the Περὶ παραπρεσβείας. The Greek commentaries ascribed to Ulpian are especially defective on the historical side, and give little essential aid. Editions:—C. W. Müller, in *Orat. Att.* ii. (1847–1858); *Scholia Graeca in Demosth. ex cod. aucta et emendata* (Oxon., 1851; in W. Dindorf's ed.).

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DEMOTIC (Gr. δημοτικός, of or belonging to the people), a term, meaning popular, specially applied to that cursive script of the ancient Egyptian language used for business and literary purposes,—for the people. It is opposed to "hieratic" (Gr. ἱερατικός, of or belonging to the priests), the script, an abridged form of the hieroglyphic, used in transcribing the religious texts. (See WRITING, and EGYPT: II., *Ancient*, D. *Language and Writing*.)

DEMOTICA, or DIMOTICA, a town of European Turkey, in the vilayet of Adrianople; on the Maritza valley branch of the Constantinople-Salonica railway, about 35 m. S. of Adrianople. Pop. (1905) about 10,000. Demotica is built at the foot of a conical hill on the left bank of the river Kizildeli, near its junction with the Maritza. It was formerly the seat of a Greek archbishop, and besides the ancient citadel and palace on the summit of the hill contains several Greek churches, mosques and public baths. In the middle ages, when it was named Didymotichos, it was one of the principal marts of Thrace; in modern times it has regained something of its commercial importance, and exports pottery, linen, silk and grain. These goods are sent to Dédéagatch for shipment. Demotica was the birthplace of the Turkish sultan Bayezid I. (1347); after the battle of Poltava, Charles XII. of Sweden resided here from February 1713 to October 1714.

DEMPSTER, THOMAS (1579–1625), Scottish scholar and historian, was born at Cliftbog, Aberdeenshire, the son of Thomas Dempster of Muresk, Auchterless and Killesmont, sheriff of Banff and Buchan. According to his own account, he was the twenty-fourth of twenty-nine children, and was early remarkable for precocious talent. He obtained his early education in Aberdeenshire, and at ten entered Pembroke Hall, Cambridge; after a short while he went to Paris, and, driven thence by the plague, to Louvain, whence by order of the pope he was transferred with several other Scottish students to the papal seminary at Rome. Being soon forced by ill-health to leave, he went to the English college at Douai, where he remained three years and took his M.A. degree. While at Douai he wrote a scurrilous attack on Queen Elizabeth, which caused a riot among the English students. But, if his truculent character was thus early displayed, his abilities were no less conspicuous; and, though still in his teens, he became lecturer on the Humanities at Tournai, whence, after but a short stay, he returned to Paris, to take his degree of doctor of canon law, and become regent of the college of Navarre. He soon left Paris for Toulouse, which in turn he was forced to leave owing to the hostility of the city authorities, aroused by his violent assertion of university rights. He was now elected professor of eloquence at the university or academy of Nîmes, but not without a murderous attack upon him by one of the defeated candidates and his supporters, followed by a suit for libel, which, though he ultimately won his case, forced him to leave the town. A short engagement in Spain, as tutor to the son of Marshal de Saint Luc, was terminated by another quarrel; and Dempster now returned to Scotland with the intention of asserting a claim to his father's estates. Finding his relatives unsympathetic, and falling into heated controversy with the Presbyterian clergy, he made no long stay, but returned to Paris, where he remained for seven years, becoming professor in several colleges successively. At last, however, his temporary connexion with the collège de Beauvais was ended by a feat of arms which proved him as stout a fighter with his sword as with his pen; and, since his victory was won over officers of the king's guard, it again became expedient for him to change his place of residence. The dedication of his edition of Rosinus' *Antiquitatum Romanorum corpus absolutissimum* to King James I. had won him an invitation to the English court; and in 1615 he went to London. His reception by the king was flattering enough; but his hopes of preferment were dashed by the opposition of the Anglican clergy to the promotion of a papist. He left for Rome, where, after a short imprisonment on suspicion of being a spy, he gained the favour of Pope Paul V., through whose influence with Cosimo II., grand duke of Tuscany, he was appointed to the professorship of the Pandects at Pisa. He had married while in London, but ere long had reason to suspect his wife's relations with a certain Englishman. Violent accusations followed, indignantly repudiated; a diplomatic correspondence ensued, and a demand was made, and supported by the grand duke, for an apology, which the professor refused to make, preferring rather to lose his chair. He now set out once more for Scotland, but was intercepted by the Florentine cardinal Luigi Capponi, who induced him to remain at Bologna as professor of Humanity. This was the most distinguished post in the most famous of continental universities, and Dempster was now at the height of his fame. Though his *Roman Antiquities* and *Scotia illustrior* had been placed on the Index pending correction, Pope Urban VIII. made him a knight and gave him a pension. He was not, however, to enjoy his honours long. His wife eloped with a student, and Dempster, pursuing the fugitives in the heat of summer, caught a fever, and died at Bologna on the 6th of September 1625.

Dempster owed his great position in the history of scholarship to his extraordinary memory, and to the versatility which made him equally at home in philology, criticism, law, biography and history. His style is, however, often barbarous; and the obvious

[1] See also H. Usener in *Nachrichten von der Königl. Gesellschaft der Wissenschaften zu Göttingen*, p. 188 (1892); J. H. Lipsius, "Zur Textcritik des Demosthenes" in *Berichte . . . der Königl. Sächsischen Gesellschaft der Wissenschaften* (1893) with special reference to the papyrus finds at the end of the 19th century; E. Bethe, *Demosthenis scriptorum corpus* (1893).

defects of his works are due to his restlessness and impetuosity, and to a patriotic and personal vanity which led him in Scottish questions into absurd exaggerations, and in matters affecting his own life into an incurable habit of romancing. The best known of his works is the *Historia ecclesiastica gentis Scotorum* (Bologna, 1627). In this book he tries to prove that Bernard (Sapiens), Alcuin, Boniface and Joannes Scotus Erigena were all Scots, and even Boadicea becomes a Scottish author. This criticism is not applicable to his works on antiquarian subjects, and his edition of Benedetto Accolti's *De bello a Christianis contra barbaros* (1623) has great merits.

A portion of his Latin verse is printed in the first volume (pp. 306-354) of *Delitiae poetarum Scotorum* (Amsterdam, 1637).

DEMURRAGE (from "demur," Fr. *demeurer*, to delay, derived from Lat. *mora*), in the law of merchant shipping, the sum payable by the freighter to the shipowner for detention of the vessel in port beyond the number of days allowed for the purpose of loading or unloading (see AFFREIGHTMENT: under *Charter-parties*). The word is also used in railway law for the charge on detention of trucks; and in banking for the charge per ounce made by the Bank of England in exchanging coin or notes for bullion.

DEMURRER (from Fr. *demeurer*, to delay, Lat. *morari*), in English law, an objection taken to the sufficiency, in point of law, of the pleading or written statement of the other side. In equity pleading a demurrer lay only against the bill, and not against the answer; at common law any part of the pleading could be demurred to. On the passing of the Judicature Act of 1875 the procedure with respect to demurrers in civil cases was amended, and, subsequently, by the Rules of the Supreme Court, Order XXV. demurrers were abolished and a more summary process for getting rid of pleadings which showed no reasonable cause of action or defence was adopted, called proceedings in lieu of demurrer. Demurrer in criminal cases still exists, but is now seldom resorted to. Demurrers are still in constant use in the United States. See ANSWER; PLEADING.

DENAIN, a town of northern France in the department of Nord, 8 m. S.W. of Valenciennes by steam tramway. A mere village in the beginning of the 19th century, it rapidly increased from 1850 onwards, and, according to the census of 1906, possessed 22,845 inhabitants, mainly engaged in the coal mines and iron-smelting works, to which it owes its development. There are also breweries, manufactories of machinery, sugar and glass. A school of commerce and industry is among the institutions. Denain has a port on the left bank of the Scheldt canal. Its vicinity was the scene of the decisive victory gained in 1712 by Marshal Villars over the allies commanded by Prince Eugène; and the battlefield is marked by a monolithic monument inscribed with the verses of Voltaire:—

"Regardez dans Denain l'audacieux Villars
Disputant le tonnerre à l'aigle des Césars."

DENBIGH, WILLIAM FEILDING, 1ST EARL OF (d. 1643), son of Basil Feilding[1] of Newnham Paddox in Warwickshire, and of Elizabeth, daughter of Sir Walter Aston, was educated at Emmanuel College, Cambridge, and knighted in 1603. He married Susan, daughter of Sir George Villiers, sister of the future duke of Buckingham, and on the rise of the favourite received various offices and dignities. He was appointed *custos rotulorum* of Warwickshire, and master of the great wardrobe in 1622, and created baron and viscount Feilding in 1620, and earl of Denbigh on the 14th of September 1622. He attended Prince Charles on the Spanish adventure, served as admiral in the unsuccessful expedition to Cadiz in 1625, and commanded the disastrous attempt upon Rochelle in 1628, becoming the same year a member of the council of war, and in 1633 a member of the council of Wales. In 1631 Lord Denbigh visited the East. On the outbreak of the Civil War he served under Prince Rupert and was present at Edgehill. On the 3rd of April 1643 during Rupert's attack on Birmingham he was wounded and died from the effects on the 8th, being buried at Monks Kirby in Warwickshire. His courage, unselfishness and devotion to duty are much praised by Clarendon.

[1] The descent of the Feildings from the house of Habsburg, through the counts of Laufenburg and Rheinfelden, long considered authentic, and immortalized by Gibbon, has been proved to have been based on forged documents. See J. H. Round, *Peerage and Family History* (1901).

See E. Lodge, *Portraits* (1850), iv. 113; J. Nichols, *Hist. of Leicestershire* (1807), iv. pt. 1, 273; Hist. MSS. *Comm Ser.* 4th Rep. app. 254; *Cal. of State Papers, Dom.*; *Studies in Peerage and Family History*, by J. H. Round (1901), 216.

His eldest son, BASIL FEILDING, and earl of Denbigh (*c.* 1608-1675), was educated at Emmanuel College, Cambridge. He was summoned to the House of Lords as Baron Feilding in March 1629. After seeing military service in the Netherlands he was sent in 1634 by Charles I. as ambassador to Venice, where he remained for five years. When the Civil War broke out Feilding, unlike the other members of his family, ranged himself among the Parliamentarians, led a regiment of horse at Edgehill, and, having become earl of Denbigh in April 1643, was made commander-in-chief of the Parliamentary army in Warwickshire and the neighbouring counties, and lord-lieutenant of Warwickshire. During the year 1644 he was fairly active in the field, but in some quarters he was distrusted and he resigned his command after the passing of the self-denying ordinance in April 1645. At Uxbridge in 1645 Denbigh was one of the commissioners appointed to treat with the king, and he undertook a similar duty at Carisbrooke in 1647. Clarendon relates how at Uxbridge Denbigh declared privately that he regretted the position in which he found himself, and expressed his willingness to serve Charles I. He supported the army in its dispute with the parliament, but he would take no part in the trial of Charles I. Under the government of the commonwealth Denbigh was a member of the council of state, but his loyalty to his former associates grew lukewarm, and gradually he came to be regarded as a royalist. In 1664 the earl was created Baron St Liz. Although four times married he left no issue when he died on the 28th of November 1675.

His titles devolved on his nephew WILLIAM FEILDING (1640-1685), son and heir of his brother George (created Baron Feilding of Lecaghe, Viscount Callan and earl of Desmond), and the earldom of Desmond has been held by his descendants to the present day in conjunction with the earldom of Denbigh.

DENBIGH (*Dinbych*), a municipal and (with Holt, Ruthin and Wrexham) contributory parliamentary borough, market town and county town of Denbighshire, N. Wales, on branches of the London & North-Western and the Great Western railways. Pop. (1901) 6438. Denbigh Castle, surrounding the hill with a double wall, was built, in Edward I.'s reign, by Henry de Lacy, earl of Lincoln, from whom the town received its first charter. The outer wall is nearly a mile round; over its main gateway is a niche with a figure representing, possibly, Edward I., but more probably, de Lacy. Here, in 1645, after the defeat of Rowton Moor, Charles I. found shelter, the castle long resisting the Parliamentarians, and being reduced to ruins by his successor. The chief buildings are the Carmelite Priory (ruins dating perhaps from the 13th century); a Bluecoat school (1514); a free grammar school (1527); an orphan girl school (funds left by Thomas Howel to the Drapers' Co., in Henry VII.'s reign); the town hall (built in 1572 by Robert Dudley, earl of Leicester, enlarged and restored in 1780); an unfinished church (begun by Leicester); a market hall (with arcades or "rows," such as those of Chester or Yarmouth); and the old parish church of St Marcella. The streams near Denbigh are the Clwyd and Elwy. The inhabitants of Denbigh are chiefly occupied in the timber trade, butter-making, poultry-farming, bootmaking, tanning and quarrying (lime, slate and paving-stones). The borough of Denbigh has a separate commission of the peace, but no separate court of quarter sessions. The town has long been known as a Welsh publishing centre, the vernacular newspaper, *Baner*, being edited and printed here. Near Denbigh, at Bodelwyddan, &c., coal is worked.

The old British tower and castle were called *Castell caled fryn yn Rhôs*, the "castle of the hard hill in Rhôs." *Din* in

Dinbych means a fort. There is a goblin well at the castle. Historically, David (*Dafydd*), brother of the last Llewelyn, was here (*aet.* Edward I.) perhaps on a foray; also Henry Lacy, who built the castle (*aet.* Edward I.), given to the Mortimers and to Leicester (under Edward III. and Elizabeth, respectively).

DENBIGHSHIRE (*Dinbych*), a county of N. Wales, bounded N. by the Irish Sea, N.E. by Flint and Cheshire, S.E. by Flint and Shropshire, S. by Montgomery and Merioneth, and W. by Carnarvon. Area, 662 sq. m. On the N. coast, within the Denbighshire borders and between Old Colwyn and Llandulas, is a wedge of land included in Carnarvonshire, owing to a change in the course of the Conwy stream. (Thus, also, Llandudno is partly in the Bangor, and partly in the St Asaph, diocese.) The surface of Denbighshire is irregular, and physically diversified. In the N.W. are the bleak Hiraethog ("longing") hills, sloping W. to the Conwy and E. to the Clwyd. In the N. are Colwyn and Abergele bays, on the S. the Yspytty (Lat. *Hospitium*) and Llangwm range, between Denbigh and Merioneth. From this watershed flow the Elwy, Aled, Clywedog, Merddwr and Alwen, tributaries of the Clwyd, Conwy and Dee (*Dyfrdwy*). Some of the valleys contrast agreeably with the bleak hills, *e.g.* those of the Clwyd and Elwy. The portion lying between Ruabon (*Rhiwabon*) hills and the Dee is agricultural and rich in minerals; the Berwyn to Offa's Dyke (*Wâl Offa*) is wild and barren, except the Tanat valley, Llansilin and Ceiriog. One feeder of the Tanat forms the Pistyll Rhaiadr (waterspout fall), another rises in Llyncaws (cheese pool) under Moel Sych (dry bare-hill), the highest point in the county. Aled and Alwen are both lakes and streams.

Geology.—The geology of the county is full of interest, as it develops all the principal strata that intervenes between the Ordovician and the Triassic series. In the Ordovician district, which extends from the southern boundary to the Ceiriog, the Llandeilo formation of the eastern slopes of the Berwyn and the Bala beds of shelly sandstone are traversed east and west by bands of intrusive felspathic porphyry and ashes. The same formation occurs just within the county border at Cerrig-y-Druidion, Langum, Bettys-y-coed and in the Fairy Glen. Northwards from the Ceiriog to the limestone fringe at Llandrillo the Wenlock shale of the Silurian covers the entire mass of the Hiraethog and Clwydian hills, but verging on its western slopes into the Denbighshire grit, which may be traced southward in a continuous line from the mouth of the Conway as far as Llanddewi Ystrad Enni in Radnorshire, near Pentre-Voelas and Conway they are abundantly fossiliferous. On its eastern slope a narrow broken band of the Old Red, or what may be a conglomeratic basement bed of the Carboniferous Limestone series, crops up along the Vale of Clwyd and in Eglwyseg. Resting upon this the Carboniferous Limestone extends from Llanymynach, its extreme southern point, to the Cyrnybrain fault, and there forks into two divisions that terminate respectively in the Great Orme's Head and in Talargoch, and are separated from each other by the denuded shales of the Moel Famma range. In the Vale of Clwyd the limestone underlies the New Red Sandstone, and in the eastern division it is itself overlaid by the Millstone Grit of Ruabon and Minera, and by a long reach of the Coal Measures which near Wrexham are 4½ m. in breadth. Eastward of these a broad strip of the red marly beds succeeds, formerly considered to be Permian but now regarded as belonging to the Coal Measures, and yet again between this and the Dee the ground is occupied—as in the Vale of Clwyd—by the New Red rocks. As in the other northern counties of Wales, the whole of the lower ground is covered more or less thickly with glacial drift. On the western side of the Vale of Clwyd, at Cefn and Plâs Heaton, the caves, which are a common feature in such limestone districts, have yielded the remains of the rhinoceros, mammoth, hippopotamus and other extinct mammals.

Coal is mined from the Coal Measures, and from the limestone below, lead with silver and zinc ores have been obtained. Valuable fireclays and terra-cotta marls are also taken from the Coal Measures about Wrexham.

The uplands being uncongenial for corn, ponies, sheep and black cattle are reared, for fattening in the Midlands of England and sale in London. Oats and turnips, rather than wheat, barley and potatoes, occupy the tilled land. The county is fairly wooded. There are several important farmers' clubs (the Denbighshire and Flintshire, the vale of Conway, the Cerrig y druidion, &c.). The London & North-Western railway (Holyhead line), with the Conway and Clwyd valleys branches, together with the lines connecting Denbigh with Ruabon (Rhiwabon), via Ruthin and Corwen, Wrexham with Connah's Quay (Great Central) and Rhosllanerchrhugog with Glyn Ceiriog (for the Great Western and Great Central railways) have opened up the county. Down the valley of Llangollen also runs the Holyhead road from London, well built and passing through fine scenery. At Nantglyn paving flags are raised, at Rhiwfelen (near Llangollen) slabs and slates, and good slates are also obtained at Glyn Ceiriog. There is plenty of limestone, with china stone at Brymbo. Cefn Rhiwabon yields sandstone (for hones) and millstone grit. Chirk, Ruabon and Brymbo have coal mines. The great Minera is the principal lead mine. There is much brick and pottery clay. The Ceiriog valley has a dynamite factory. Llangollen and Llansantffraid (St Bridgit's) have woollen manufactures.

The area of the ancient county is 423,499 acres, with a population in 1901 of 129,942. The area of the administrative county is 426,084 acres. The chief towns are: Wrexham, a mining centre and N. Wales military centre, with a fine church; Denbigh; Ruthin, where assizes are held (here are a grammar school, a warden and a 13th-century castle rebuilt); Llangollen and Llanrwst; and Holt, with an old ruined castle. The Denbigh district of parliamentary boroughs is formed of: Denbigh (pop. 6483), Holt (1059), Ruthin (2643), and Wrexham (14,966). The county has two parliamentary divisions. The urban districts are: Abergele and Pensarn (2083), Colwyn Bay and Colwyn (8689), Llangollen (3303), and Llanrwst (2645). Denbighshire is in the N. Wales circuit, assizes being held at Ruthin. Denbigh and Wrexham boroughs have separate commissions of the peace, but no separate quarter-session courts. The ancient county, which is in the diocese of St Asaph, contains seventy-five ecclesiastical parishes and districts and part of a parish.

The county was formed, by an act of Henry VIII., out of the lordships of Denbigh, Ruthin (Rhuthyn), Rhos and Rhyfoniog, which are roughly the Perfeddwlad (midland) between Conway and Clwyd, and the lordships of Bromfield, Yale (*Iâl*, open land) and Chirkland, the old possessions of Gruffydd ap Madoc, *arglwydd* (lord) of Dinas Brân. Cefn (Elwy Valley) limestone caves hold the prehistoric hippopotamus, elephant, rhinoceros, lion, hyena, bear, reindeer, &c.; Plâs Heaton cave, the glutton; Pont Newydd, felstone tools and a polished stone axe (like that of Rhosdigre); Carnedd Tyddyn Bleiddian, "platycnemic (skeleton) men of Denbighshire" (like those of Perthi Chwareu). Clawdd Coch has traces of the Romans; so also Penygaer and Penbarras. Roman roads ran from Deva (Chester) to Segontium (Carnarvon) and from Deva to Mons Heriri (*Tomen y mur*). To their period belong the inscribed Gwytherin and Pentrefoelas (near Bettws-y-coed) stones. The Valle Crucis "Eliseg's pillar" tells of Brochmael and the Cairlegion (Chester) struggle against Æthelfrith's invading Northumbrians, A.D. 613, while Offa's dike goes back to the Mercian advance. Near and parallel to Offa's is the shorter and mysterious Watt's dike. Chirk is the only Denbighshire castle comparatively untouched by time and still occupied. Ruthin has cloisters; Wrexham, the Brynffynnon "nunnery"; and at both are collegiate churches. Llanrwst, Gresford and Derwen boast rood lofts and screens; Whitchurch and Llanrwst, portrait brasses and monuments; Derwen, a churchyard cross; Gresford and Llanrhaiadr (Dyffryn Clwyd), stained glass. Near Abergele, known for its sea baths, is the *ogof* (or cave), traditionally the refuge of Richard II. and the scene of his capture by Bolingbroke in 1399.

See J. Williams, *Denbigh* (1856), and T. F. Tout, *Welsh Shires*.

DENDERA, a village in Upper Egypt, situated in the angle of the great westward bend of the Nile opposite Kena. Here was the ancient city of Tentyra, capital of the Tentyrite nome, the sixth of Upper Egypt, and the principal seat of the worship of Hathor [Aphrodite] the cow-goddess of love and joy. The old Egyptian name of Tentyra was written 'In·t (Ant), but the pronunciation of it is unknown: in later days it was 'In·t-t-ntr·t, "ant of the goddess," pronounced Ni-tentôri, whence Τέντυρα, Τέντυρις. The temple of Hathor was built in the 1st century B.C., being begun under the later Ptolemies (Ptol. XIII.) and finished by Augustus, but much of the decoration is later. A great

rectangular enclosure of crude bricks, measuring about 900 × 850 ft., contains the sacred buildings: it was entered by two stone gateways, in the north and the east sides, built by Domitian. Another smaller enclosure lies to the east with a gateway also of the Roman period.

The plan of the temple may be supposed to have included a colonnaded court in front of the present façade, and pylon towers at the entrance; but these were never built, probably for lack of funds. The building, which is of sandstone, measures about 300 ft. from front to back, and consists of two oblong rectangles; the foremost, placed transversely to the other, is the great hypostyle hall or pronaos, the broadest and loftiest part of the temple, measuring 135 ft. in width, and comprising about one-third of the whole structure; the façade has six columns with heads of Hathor, and the ceiling is supported by eighteen great columns. The second rectangle contains a small hypostyle hall with six columns, and the sanctuary, with their subsidiary chambers. The sanctuary is surrounded by a corridor into which the chambers open: on the west side is an apartment forming a court and kiosk for the celebration of the feast of the New Year, the principal festival of Dendera. On the roof of the temple, reached by two staircases, are a pavilion and several chambers dedicated to the worship of Osiris. Inside and out, the whole of the temple is covered with scenes and inscriptions in crowded characters, of ceremonial and religious import; the decoration is even carried into a remarkable series of hidden passages and chambers or crypts made in the solid walls for the reception of its most valuable treasures. The architectural style is dignified and pleasing in design and proportions. The interior of the building has been completely cleared: from the outside, however, its imposing effect is quite lost, owing to the mounds of rubbish amongst which it is sunk. North-east of the entrance is a "Birth House" for the cult of the child Harsemteu, and behind the temple a small temple of Isis, dating from the reign of Augustus. The original foundation of the temple must date back to a remote time: the work of some of the early builders is in fact referred to in the inscriptions on the present structure. Petrie's excavation of the cemetery behind the temple enclosures revealed burials dating from the fourth dynasty onwards, the most important being mastables of the period from the sixth to the eleventh dynasties; many of these exhibited a peculiar degradation of the contemporary style of sculpture.

The zodiacs of the temple of Dendera gave rise to a considerable literature before their late origin was established by Champollion in 1822: one of them, from a chamber on the roof, was removed in 1820 to the Bibliothèque Nationale in Paris. Figures of the celebrated Cleopatra VI. occur amongst the sculptures on the exterior of the temple, but they are purely conventional, without a trace of portraiture. Horus of Edfu, the enemy of the crocodiles and hippopotami of Set, appears sometimes as the consort of Hathor of Dendera. The skill displayed by the Tentyrites in capturing the crocodile is referred to by Strabo and other Greek writers. Juvenal, in his seventeenth satire, takes as his text a religious riot between the Tentyrites and the neighbouring Ombites, in the course of which an unlucky Ombite was torn to pieces and devoured by the opposite party. The Ombos in question is not the distant Ombos south of Edfu, where the crocodile was worshipped; Petrie has shown that opposite Coptos, only about 15 m. from Tentyra, there was another Ombos, venerating the hippopotamus sacred to Set.

See A. Mariette, *Dendérah* (5 vols. atlas and text, 1869–1880); W. M. F. Petrie, *Denderah* (1900); *Nagada* and *Ballas* (1896).

(F. Ll. G.)

DENDROCOMETES (so named by F. Stein), a genus of suctorian Infusoria, characterized by the repeatedly branched attached body; each of the lobes of the body gives off a few retractile tentacles. It is parasitic on the gills of the so-called freshwater shrimp *Gammarus pulex*.

For its conjugation see Sydney H. Hickson, in *Quarterly Journ. of Microsc. Science*, vol. xlv. (1902), p. 325.

DENE-HOLES, the name given to certain caves or excavations in England, which have been popularly supposed to be due to the Danes or some other of the early northern invaders of the country. The common spelling "Dane hole" is adduced as evidence of this, and individual names, such as Vortigern's Caves at Margate, and Canute's Gold Mine near Bexley, naturally follow the same theory. The word, however, is probably derived from the Anglo-Saxon *den*, a hole or valley. There are many underground excavations in the south of the country, also found to some extent in the midlands and the north, but true dene-holes are found chiefly in those parts of Kent and Essex along the lower banks of the Thames. With one exception there are no recorded specimens farther east than those of the Grays Thurrock district, situated in Hangman's Wood, on the north, and one near Rochester on the south side of the river.

The general outline of the formation of these caves is invariably the same. The entrance is a vertical shaft some 3 ft. in diameter falling, on an average, to a depth of 60 ft. The depth is regulated, obviously, by the depth of the chalk from the surface, but, although chalk could have been obtained close at hand within a few feet, or even inches, from the surface, a depth of from 45 to 80 ft., or more, is a characteristic feature. It is believed that dene-holes were also excavated in sand, but as these would be of a perishable nature there are no available data of any value. The shaft, when the chalk is reached, widens out into a domed chamber with a roof of chalk some 3 ft. thick. The walls frequently contract somewhat as they near the floor. As a rule there is only one chamber, from 16 to 18 ft. in height, beneath each shaft. From this excessive height it has been inferred that the caves were not primarily intended for habitations or even hiding-places. In some cases the chamber is extended, the roof being supported by pillars of chalk left standing. A rare specimen of a twin-chamber was discovered at Gravesend. In this case the one entrance served for both caves, although a separate aperture connected them on the floor level. Where galleries are found connecting the chambers, forming a bewildering labyrinth, a careful scrutiny of the walls usually reveals evidence that they are the work of a people of a much later period than that of the chambers, or, as they become in these cases, the halls of the galleries.

Isolated specimens have been discovered in various parts of Kent and Essex, but the most important groups have been found at Grays Thurrock, in the districts of Woolwich, Abbey Wood and Bexley, and at Gravesend. Those at Bexley and Grays Thurrock are the most valuable still existing.

It is generally found that the tool work on the roof or ceiling is rougher than that on the walls, where an upright position could be maintained. Casts taken of some of the pick-holes near the roof show that, in all probability, they were made by bone or horn picks. And numerous bone picks have been discovered in Essex and Kent. These pick-holes are amongst the most valuable data for the study of dene-holes, and have assisted in fixing the date of their formation to pre-Roman times. Very few relics of antiquarian value have been discovered in any of the known dene-holes which have assisted in fixing the date or determining the uses of these prehistoric excavations. Pliny mentions pits sunk to a depth of a hundred feet, "where they branched out like the veins of mines." This has been used in support of the theory that dene-holes were wells sunk for the extraction of chalk; but no known dene-hole branches out in this way. Chrétien de Troyes has a passage on underground caves in Britain which may have reference to dene-holes, and tradition of the 14th century treated the dene-holes of Grays as the fabled gold mines of Cunobeline (or Cymbeline) of the 1st century.

Vortigern's Caves at Margate are possibly dene-holes which have been adapted by later peoples to other purposes; and excellent examples of various pick-holes may be seen on different parts of the walls.

Local tradition in some cases traces the use of these caves to the smugglers, and, when it is remembered that illicit traffic was common not only on the coast but in the Thames as far up the river as Barking Creek, the theory is at least tenable that these ready-made hiding-places, difficult of approach and dangerous to descend, were so utilized.

There are three purposes for which dene-holes may have been originally excavated: (*a*) as hiding-places or dwellings, (*b*) draw-wells for the extraction of chalk for agricultural uses, and (*c*) store-houses for grain. For several reasons it is unlikely that they were used as habitations, although they may have been used occasionally as hiding-places. Other evidence has shown that it is equally improbable that they were used for the extraction of chalk. The chief reasons against this theory are that chalk could have been obtained outcropping close by, and that every trace of loose chalk has been removed from the vicinity of the holes, while known examples of chalk draw-wells do not descend to so great a depth. The discovery of a shallow dene-hole, about 14 ft. below the surface, at Stone negatives this theory still further. The last of the three possible uses for which these prehistoric excavations were designed is usually accepted as the most probable. Silos, or underground storehouses, are well known in the south of Europe and Morocco. It is supposed that the grain was stored in the ear and carefully protected from damp by straw. A curious smoothness of the roof of one of the chambers of the Gravesend twin-chamber dene-hole has been put forward as additional evidence in support of this theory. One other theory has been advanced, viz. that the excavations were made in order to get flints for implements, but this is quite impossible, as a careful examination of a few examples will show.

Further reference may be made to *Essex Dene-holes* by T. V. Holmes and W. Cole; to *The Archaeological Journal* (1882); the *Transactions* of the Essex Field Club; *Archaeologia Cantiana*, &c.; *Dene-holes* by F. W. Reader, in *Old Essex*, ed. A. C. Kelway (1908).

(A. J. P.)

DENGUE (pronounced deng-ga), an infectious fever occurring in warm climates. The symptoms are a sudden attack of fever, accompanied by rheumatic pains in the joints and muscles with severe headache and erythema. After a few days a crisis is reached and an interval of two or three days is followed by a slighter return of fever and pain and an eruption resembling measles, the most marked characteristic of the disease. The disease is rarely fatal, death occurring only in cases of extreme weakness caused by old age, infancy or other illness. Little is known of the aetiology of "dengue." The virus is probably similar to that of other exanthematous fevers and communicated by an intermediary culex. The disease is nearly always epidemic, though at intervals it appears to be pandemic and in certain districts almost endemic. The area over which the disease ranges may be stated generally to be between 32° 47′ N. and 23° 23′ S. Throughout this area "dengue" is constantly epidemic. The earliest epidemic of which anything is known occurred in 1779–1780 in Egypt and the East Indies. The chief epidemics have been those of 1824–1826 in India, and in the West Indies and the southern states of North America, of 1870–1875, extending practically over the whole of the tropical portions of the East and reaching as far as China. In 1888 and 1889 a great outbreak spread along the shores of the Aegean and over nearly the whole of Asia Minor. Perhaps "dengue" is most nearly endemic in equatorial East Africa and in the West Indies. The word has usually been identified with the Spanish *dengue*, meaning stiff or prim behaviour, and adopted in the West Indies as a name suitable to the curious cramped movements of a sufferer from the disease, similar to the name "dandy-fever" which was given to it by the negroes. According to the *New English Dictionary* (quoting Dr Christie in *The Glasgow Medical Journal*, September 1881), both "dengue" and "dandy" are corruptions of the Swahili word *dinga* or *denga*, meaning a sudden attack of cramp, the Swahili name for the disease being *ka-dinga pepo*.

See Sir Patrick Manson, *Tropical Diseases: a Manual of Diseases of Warm Climates* (1903).

DENHAM, DIXON (1786–1828), English traveller in West Central Africa, was born in London on the 1st of January 1786. He was educated at Merchant Taylors' School, and was articled to a solicitor, but joined the army in 1811. First in the 23rd Royal Welsh Fusiliers, and afterwards in the 54th foot, he served in the campaigns in Portugal, Spain, France and Belgium, and received the Waterloo medal. In 1821 he volunteered to join Dr Oudney and Hugh Clapperton (*q.v.*), who had been sent by the British government via Tripoli to the central Sudan. He joined the expedition at Murzuk in Fezzan. Finding the promised escort not forthcoming, Denham, whose energy was boundless, started for England to complain of the "duplicity" of the pasha of Tripoli. The pasha, alarmed, sent messengers after him with promises to meet his demands. Denham, who had reached Marseilles, consented to return, the escor was forthcoming, and Murzuk was regained in November 1822. Thence the expedition made its way across the Sahara to Bornu, reached in February 1823. Here Denham, against the wish of Oudney and Clapperton, accompanied a slave-raiding expedition into the Mandara highlands south of Bornu. The raiders were defeated, and Denham barely escaped with his life. When Oudney and Clapperton set out, December 1823, for the Hausa states, Denham remained behind. He explored the western, south and south-eastern shores of Lake Chad, and the lower courses of the rivers Waube, Logone and Shari. In August 1824, Clapperton having returned and Oudney being dead, Bornu was left on the return journey to Tripoli and England. In December 1826 Denham, promoted lieutenant-colonel, sailed for Sierra Leone as superintendent of liberated Africans. In 1828 he was appointed governor of Sierra Leone, but after administering the colony for five weeks died of fever at Freetown on the 8th of May 1828.

See *Narrative of Travels and Discoveries in Northern and Central Africa in the years 1822–1824* (London, 1826), the greater part of which is written by Denham; *The Story of Africa*, vol. i. chap. xiii. (London, 1892), by Dr Robert Brown.

DENHAM, SIR JOHN (1615–1669), English poet, only son of Sir John Denham (1559–1639), lord chief baron of the exchequer in Ireland, was born in Dublin in 1615. In 1617 his father became baron of the exchequer in England, and removed to London with his family. In Michaelmas term 1631 the future poet was entered as a gentleman commoner at Trinity College, Oxford. He removed in 1634 to Lincoln's Inn, where he was, says John Aubrey, a good student, but not suspected of being a wit. The reputation he had gained at Oxford of being the "dreamingest young fellow" gave way to a scandalous reputation for gambling. In 1634 he married Ann Cotton, and seems to have lived with his father at Egham, Surrey. In 1636 he wrote his paraphrase of the second book of the Aeneid (published in 1656 as *The Destruction of Troy*, with an excellent verse essay on the art of translation). About the same time he wrote a prose tract against gambling, *The Anatomy of Play* (printed 1651), designed to assure his father of his repentance, but as soon as he came into his fortune he squandered it at play. It was a surprise to everyone when in 1642 he suddenly, as Edmund Waller said, "broke out like the Irish rebellion, three score thousand strong, when no one was aware, nor in the least expected it," by publishing *The Sophy*, a tragedy in five acts, the subject of which was drawn from Sir Thomas Herbert's travels. At the beginning of the Civil War Denham was high sheriff for Surrey, and was appointed governor of Farnham Castle. He showed no military ability, and speedily surrendered the castle to the parliament. He was sent as a prisoner to London, but was soon permitted to join the king at Oxford.

In 1642 appeared *Cooper's Hill*, a poem describing the Thames scenery round his home at Egham. The first edition was anonymous: subsequent editions show numerous alterations, and the poem did not assume its final form until 1655. This famous piece, which was Pope's model for his *Windsor Forest*, was not new in theme or manner, but the praise which it received was well merited by its ease and grace. Moreover Denham expressed his commonplaces with great dignity and skill. He followed the taste of the time in his frequent use of antithesis and metaphor, but these devices seem to arise out of the matter, and are not of the nature of mere external ornament. At Oxford he wrote many squibs against the roundheads. One of the few serious pieces belonging to this period is the short poem "On the Earl of Strafford's Trial and Death."

From this time Denham was much in Charles I.'s confidence. He was entrusted with the charge of forwarding letters to and from the king when he was in the custody of the parliament, a

duty which he discharged successfully with Abraham Cowley, but in 1648 he was suspected by the Parliamentary authorities, and thought it wiser to cross the Channel. He helped in the removal of the young duke of York to Holland, and for some time he served Queen Henrietta Maria in Paris, being entrusted by her with despatches for Holland. In 1650 he was sent to Poland in company with Lord Crofts to obtain money for Charles II. They succeeded in raising £10,000. After two years spent at the exiled court in Holland, Denham returned to London, and being quite without resources, he was for some time the guest of the earl of Pembroke at Wilton. In 1655 an order was given that Denham should restrict himself to some place of residence to be selected by himself at a distance of not less than 20 m. from London; subsequently he obtained from the Protector a licence to live at Bury St Edmunds, and in 1658 a passport to travel abroad with the earl of Pembroke. At the Restoration Denham's services were rewarded by the office of surveyor-general of works. His qualifications as an architect were probably slight, but it is safe to regard as grossly exaggerated the accusations of incompetence and peculation made by Samuel Butler in his brutal "Panegyric upon Sir John Denham's Recovery from his Madness." He eventually secured the services of Christopher Wren as deputy-surveyor. In 1660 he was also made a knight of the Bath.

In 1665 he married for the second time. His wife, Margaret, daughter of Sir William Brooke, was, according to the comte de Gramont, a beautiful girl of eighteen. She soon became known as the mistress of the duke of York, and the scandal, according to common report, shattered the poet's reason. While Denham was recovering, his wife died, poisoned, it was said, by a cup of chocolate. Some suspected the duchess of York of the crime, but the Comte de Gramont says that the general opinion was that Denham himself was guilty. No sign of poison, however, was found in the examination after Lady Denham's death. Denham survived her for two years, dying at his house near Whitehall in March 1669. He was buried on the 23rd in Westminster Abbey. In the last years of his life he wrote the bitter political satires on the shameful conduct of the Dutch War entitled "Directions to a Painter," and "Fresh Directions," continuing Edmund Waller's "Instructions to a Painter." The printer of these poems, with which were printed one by Andrew Marvell, was sentenced to stand in the pillory. In 1667 Denham wrote his beautiful elegy on Abraham Cowley.

Denham's poems include, beside those already given, a verse paraphrase of Cicero's *Cato major*, and a metrical version of the Psalms. As a writer of didactic verse, he was perhaps too highly praised by his immediate successors. Dryden called *Cooper's Hill* "the exact standard of good writing," and Pope in his *Windsor Forest* called him "majestic Denham." His collected poems with a dedicatory epistle to Charles II. appeared in 1668. Other editions followed, and they are reprinted in Chalmers' (1810) and other collections of the English poets. His political satires were printed with some of Rochester's and Marvell's in *Bibliotheca curiosa*, vol. i. (Edinburgh, 1885).

DÉNIA, a seaport of eastern Spain, in the province of Alicante; on the Mediterranean Sea, at the head of a railway from Carcagente. Pop. (1900) 12,431. Dénia occupies the seaward slopes of a hill surmounted by a ruined castle, and divided by a narrow valley on the south from the limestone ridge of Mongó (2500 ft.), which commands a magnificent view of the Balearic Islands and the Valencian coast. The older houses of Dénia are characterized by their flat Moorish roofs (*azoteas*) and view-turrets (*miradores*), while fragments of the Moorish ramparts are also visible near the harbour; owing, however, to the rapid extension of local commerce, many of the older quarters were modernized at the beginning of the 20th century. Nails, and woollen, linen and esparto grass fabrics are manufactured here; and there is a brisk export trade in grapes, raisins and onions, mostly consigned to Great Britain or the United States. Baltic timber and British coal are largely imported. The harbour bay, which is well lighted and sheltered by a breakwater, contains only a small space of deep water, shut in by deposits of sand on three sides. In 1904 it accommodated 403 vessels of 175,000 tons; about half of which were small fishing craft, and coasters carrying agricultural produce to Spanish and African ports.

Dénia was colonized by Greek merchants from Emporiae (Ampurias in Catalonia), or Massilia (Marseilles), at a very early date; but its Greek name of *Hemeroskopeion* was soon superseded by the Roman *Dianium*. In the 1st century B.C., Sertorius made it the naval headquarters of his resistance to Rome; and, as its name implies, it was already famous for its temple of Diana, built in imitation of that at Ephesus. The site of this temple can be traced at the foot of the castle hill. Dénia was captured by the Moors in 713, and from 1031 to 1253 belonged successively to the Moorish kingdoms of Murcia and Valencia. According to an ancient but questionable tradition, its population rose at this period to 50,000, and its commerce proportionately increased. After the city was retaken by the Christians in 1253, its prosperity dwindled away, and only began to revive in the 19th century. During the War of the Spanish Succession (1701–14), Dénia was thrice besieged; and in 1813 the citadel was held for five months by the French against the allied British and Spanish forces, until the garrison was reduced to 100 men, and compelled to surrender, on honourable terms.

DENIKER, JOSEPH (1852–) French naturalist and anthropologist, was born of French parents at Astrakhan, Russia, on the 6th of March 1852. After receiving his education at the university and technical institute of St Petersburg, he adopted engineering as a profession, and in this capacity travelled extensively in the petroleum districts of the Caucasus, in Central Europe, Italy and Dalmatia. Settling at Paris in 1876, he studied at the Sorbonne, where he took his degree in natural science. In 1888 he was appointed chief librarian of the Natural History Museum, Paris. Among his many valuable ethnological works mention may be made of *Recherches anatomiques et embryologiques sur les singes anthropoides* (1886); *Étude sur les Kalmouks* (1883); *Les Ghiliaks* (1883); and *Races et peuples de la terre* (1900). He became one of the chief editors of the *Dictionnaire de géographie universelle*, and published many papers in the anthropological and zoological journals of France.

DENILIQUIN, a municipal town of Townsend county, New South Wales, Australia, 534 m. direct S.W. of Sydney, and 195 m. by rail N. of Melbourne. Pop. (1901) 2644. The business of the town is chiefly connected with the interests of the sheep and cattle farmers of the Riverina district, a plain country, in the main pastoral, but suited in some parts for cultivation. Deniliquin has a well-known public school.

DENIM (an abbreviation of *serge de Nîmes*), the name originally given to a kind of serge. It is now applied to a stout twilled cloth made in various colours, usually of cotton, and used for overalls, &c.

DENINA, CARLO GIOVANNI MARIA (1731–1813), Italian historian, was born at Revello, Piedmont, in 1731, and was educated at Saluzzo and Turin. In 1753 he was appointed to the chair of humanity at Pignerol, but he was soon compelled by the influence of the Jesuits to retire from it. In 1756 he graduated as doctor in theology, and began authorship with a theological treatise. Promoted to the professorship of humanity and rhetoric in the college of Turin, he published (1769–1772) his *Delle rivolusioni d'Italia*, the work on which his reputation is mainly founded. Collegiate honours accompanied the issue of its successive volumes, which, however, at the same time multiplied his foes and stimulated their hatred. In 1782, at Frederick the Great's invitation, he went to Berlin, where he remained for many years, in the course of which he published his *Vie et règne de Frédéric II* (Berlin, 1788) and *La Prusse littéraire sous Frédéric II* (3 vols., Berlin, 1790–1791). His *Delle rivoluzioni della Germania* was published at Florence in 1804, in which year he went to Paris as the imperial librarian, on the invitation of Napoleon. At Paris he published in 1805 his *Tableau de la Haute Italie, et des Alpes qui l'entourent*. He died there on the 5th of December 1813.

DENIS (DIONYSIUS), **SAINT**, first bishop of Paris, patron saint of France. According to Gregory of Tours (*Hist. Franc.* i. 30), he was sent into Gaul at the time of the emperor Decius. He suffered martyrdom at the village of Catullacus, the modern St-Denis. His tomb was situated by the side of the Roman road,

where rose the priory of St-Denis-de-l'Estrée, which existed until the 18th century. In the 5th century the clergy of the diocese of Paris built a basilica over the tomb. About 625 Dagobert, son of Lothair II., founded in honour of St Denis, at some distance from the basilica, the monastery where the greater number of the kings of France have been buried. The festival of St Denis is celebrated on the 9th of October. With his name are already associated in the *Martyrologium Hieronymianum* the priest Rusticus and the deacon Eleutherius. Other traditions—of no value—are connected with the name of St Denis. A false interpretation of Gregory of Tours, apparently dating from 724, represented St Denis as having received his mission from Pope Clement, and as having suffered martyrdom under Domitian (81–96). Hilduin, abbot of St-Denis in the first half of the 9th century, identified Denis of Paris with Denis (Dionysius) the Areopagite (mentioned in Acts xviii. 34), bishop of Athens (Eusebius, *Hist. Eccl.* iii. 4. 10, iv. 23. 3), and naturally attributed to him the celebrated writings of the pseudo-Areopagite. St Denis is generally represented carrying his head in his hands.

See *Acta Sanctorum*, Octobris, iv. 696-987; *Bibliotheca hagiographica graeca*, p. 37 (Brussels, 1895); *Bibliotheca hagiographica latina*, No. 2171-2203 (Brussels, 1899); J. Havet, *Les Origines de Saint-Denis*, in his collected works, i. 191-246 (Paris, 1896); Cahier, *Caractéristiques des saints*, p. 761 (Paris, 1867). (H. De.)

DENIS, JOHANN NEPOMUK COSMAS MICHAEL (1729–1800), Austrian poet, was born at Schärding on the Inn, on the 27th of September 1729. He was brought up by the Jesuits, entered their order, and in 1759 was appointed professor in the Theresianum in Vienna, a Jesuit college. In 1784, after the suppression of the college, he was made second custodian of the court library, and seven years later became chief librarian. He died on the 29th of September 1800. A warm admirer of Klopstock, he was one of the leading members of the group of so-called "bards"; and his original poetry, published under the title *Die Lieder Sineds des Barden* (1772), shows all the extravagances of the "bardic" movement. He is best remembered as the translator of *Ossian* (1768–1769; also published together with his own poems in 5 vols, as *Ossians und Sineds Lieder*, 1784). More important than either his original poetry or his translations were his efforts to familiarize the Austrians with the literature of North Germany; his *Sammlung kürzerer Gedichte aus den neuern Dichtern Deutschlands*, 3 vols. (1762–1766), was in this respect invaluable. He has also left a number of bibliographical compilations, *Grundriss der Bibliographie und Bücherkunde* (1774), *Grundriss der Literaturgeschichte* (1776), *Einleitung in die Bücherkunde* (1777) and *Wiens Buchdruckergeschichte bis 1560* (1782).

Ossians und Sineds Lieder have not been reprinted since 1791; but a selection of his poetry edited by R. Hamel will be found in vol. 48 (1884) of Kürschner's *Deutsche Nationalliteratur*. His *Literarischer Nachlass* was published by J. F. von Retzer in 1802 (2 vols.). See P. von Hofmann-Wellenhof, *Michael Denis* (1881).

DENISON, GEORGE ANTHONY (1805–1896), English churchman, brother of John Evelyn Denison (1800–1873; speaker of the House of Commons 1857–1872; Viscount Ossington), was born at Ossington, Notts, on the 11th of December 1805, and educated at Eton and Christ Church, Oxford. In 1828 he was elected fellow of Oriel; and after a few years there as a tutor, during which he was ordained and acted as curate at Cuddesdon, he became rector of Broadwindsor, Dorset (1838). He became a prebendary of Sarum in 1841 and of Wells in 1849. In 1851 he was preferred to the valuable living of East Brent, Somerset, and in the same year was made archdeacon of Taunton. For many years Archdeacon Denison represented the extreme High Tory party not only in politics but in the Church, regarding all "progressive" movements in education or theology as abomination, and vehemently repudiating the "higher criticism" from the days of *Essays and Reviews* (1860) to those of *Lux Mundi* (1890). In 1853 he resigned his position as examining chaplain to the bishop of Bath and Wells owing to his pronounced eucharistic views. A suit on the complaint of a neighbouring clergyman ensued and after various complications Denison was condemned by the archbishops' court at Bath (1856); but on appeal the court of Arches and the privy council quashed this judgment on a technical plea. The result was to make Denison a keen champion of the ritualistic school. He edited *The Church and State Review* (1862–1865). Secular state education and the "conscience clause" were anathema to him. Until the end of his life he remained a protagonist in theological controversy and a keen fighter against latitudinarianism and liberalism; but the sharpest religious or political differences never broke his personal friendships and his Christian charity. Among other things for which he will be remembered was his origination of harvest festivals. He died on the 21st of March 1896.

DENISON, GEORGE TAYLOR (1839–), Canadian soldier and publicist, was born in Toronto on the 31st of August 1839. In 1861 he was called to the bar, and was from 1865–1867 a member of the city council. From the first he took a prominent part in the organization of the military forces of Canada, becoming a lieutenant-colonel in the active militia in 1866. He saw active service during the Fenian raid of 1866, and during the rebellion of 1885. Owing to his dissatisfaction with the conduct of the Conservative ministry during the Red River Rebellion in 1869–70, he abandoned that party, and in 1872 unsuccessfully contested Algoma in the Liberal interest. Thereafter he remained free from party ties. In 1877 he was appointed police magistrate of Toronto. Colonel Denison was one of the founders of the "Canada First" party, which did much to shape the national aspirations from 1870 to 1878, and was a consistent supporter of imperial federation and of preferential trade between Great Britain and her colonies. He became a member of the Royal Society of Canada, and was president of the section dealing with English history and literature. The best known of his military works is his *History of Modern Cavalry* (London, 1877), which was awarded first prize by the Russian government in an open competition and has been translated into German, Russian and Japanese. In 1900 he published his reminiscences under the title of *Soldiering in Canada*.

DENISON, a city of Grayson county, Texas, U.S.A., about 2½ m. from the S. bank of the Red river, about 70 m. N. of Dallas. Pop. (1890) 10,958; (1900) 11,807, of whom 2251 were negroes; (1906 estimate) 12,317. It is served by the Houston & Texas Central, the Missouri, Kansas & Texas, the Texas & Pacific, and the St Louis & San Francisco ('Frisco System) railways, and is connected with Sherman, Texas, by an electric line. Denison is the seat of the Gate City business college (generally known as Harshaw Academy), and of St Xavier's academy (Roman Catholic). It is chiefly important as a railway centre, as a collecting and distributing point for the fruit, vegetables, hogs and poultry, and general farming products of the surrounding region, and as a wholesale and jobbing market for the upper Red river valley. It has railway repair shops, and among its manufactures are cotton-seed oil, cotton, machinery and foundry products, flour, wooden-ware, and dairy products. In 1905 its factory products were valued at $1,234,956, 47·0 % more than in 1900. Denison was settled by Northerners at the time of the construction of the Missouri, Kansas & Texas railway to this point in 1872, and was named in honour of George Denison (1822–1876), a director of the railway; it became a city in 1891, and in 1907 adopted the commission form of government.

DENIZEN (derived through the Fr. from Lat. *de intus*, "from within," *i.e.* as opposed to "foreign"), an alien who obtains by letters patent (*ex donatione regis*) certain of the privileges of a British subject. He cannot be a member of the privy council or of parliament, or hold any civil or military office of trust, or take a grant of land from the crown. The Naturalization Act 1870 provides that nothing therein contained shall affect the grant of any letters of denization by the sovereign.

DENIZLI (anc. *Laodicea* (*q.v.*) *ad Lycum*), chief town of a sanjak of the Aidin vilayet of Asia Minor, altitude 1167 ft. Pop. about 17,000. It is beautifully situated at the foot of Baba Dagh (Mt. Salbacus), on a tributary of the Churuk Su (Lycus), and is connected by a branch line with the station of Gonjeli on the Smyrna-Dineir railway. It took the place of Laodicea when that town was deserted during the wars between the

Byzantines and Seljuk Turks, probably between 1158 and 1174. It had become a fine Moslem city in the 14th century, and was then called Ladik, being famous for the woven and embroidered products of its Greek inhabitants. The delightful gardens of Denizli have obtained for it the name of the "Damascus of Anatolia."

DENMAN, THOMAS, 1ST BARON (1779-1854), English judge, was born in London, the son of a well-known physician, on the 23rd of July 1779. He was educated at Eton and St John's College, Cambridge, where he graduated in 1800. Soon after leaving Cambridge he married; and in 1806 he was called to the bar at Lincoln's Inn, and at once entered upon practice. His success was rapid, and in a few years he attained a position at the bar second only to that of Brougham and Scarlett (Lord Abinger). He distinguished himself by his eloquent defence of the Luddites; but his most brilliant appearance was as one of the counsel for Queen Caroline. His speech before the Lords was very powerful, and some competent judges even considered it not inferior to Brougham's. It contained one or two daring passages, which made the king his bitter enemy, and retarded his legal promotion. At the general election of 1818 he was returned M.P. for Wareham, and at once took his seat with the Whig opposition. In the following year he was returned for Nottingham, for which place he continued to sit till his elevation to the bench in 1832. His liberal principles had caused his exclusion from office till in 1822 he was appointed common serjeant by the corporation of London. In 1830 he was made attorney-general under Lord Grey's administration. Two years later he was made lord chief justice of the King's Bench, and in 1834 he was raised to the peerage. As a judge he is most celebrated for his decision in the important privilege case of *Stockdale* v. *Hansard* (9 Ad. & El. I.; 11 Ad. & El. 253), but he was never ranked as a profound lawyer. In 1850 he resigned his chief justiceship and retired into private life. He died on the 26th of September 1854, his title continuing in the direct line.

The HON. GEORGE DENMAN (1819–1896), his fourth son, was also a distinguished lawyer, and a judge of the Queen's Bench from 1872 till his death in 1896.

See Memoir of *Thomas, first Lord Denman*, by Sir Joseph Arnould (2 vols., 1873); E. Manson, *Builders of our Law* (1904).

DENMARK (*Danmark*), a small kingdom of Europe, occupying part of a peninsula and a group of islands dividing the Baltic and North Seas, in the middle latitudes of the eastern coast. The kingdom lies between 54° 33′ and 57° 45′ N. and between 8° 4′ 54″ and 12° 47′ 25″ E., exclusive of the island of Bornholm, which, as will be seen, is not to be included in the Danish archipelago. The peninsula is divided between Denmark and Germany (Schleswig-Holstein). The Danish portion is the northern and the greater, and is called Jutland (Dan. *Jylland*). Its northern part is actually insular, divided from the mainland by the Limfjord or Liimfjord, which communicates with the North Sea to the west and the Cattegat to the east, but this strait, though broad and possessing lacustrine characteristics to the west, has only very narrow entrances. The connexion with the North Sea dates from 1825. The Skagerrack bounds Jutland to the north and north-west. The Cattegat is divided from the Baltic by the Danish islands, between the east coast of the Cimbric peninsula in the neighbourhood of the German frontier and south-western Sweden.

There is little variety in the surface of Denmark. It is uniformly low, the highest elevation in the whole country, the Himmelbjerg near Aarhus in eastern Jutland, being little more than 500 ft. above the sea. Denmark, however, is nowhere low in the sense in which Holland is; the country is pleasantly diversified, and rises a little at the coast even though it remains flat inland. The landscape of the islands and the south-eastern part of Jutland is rich in beech-woods, corn-fields and meadows, and even the minute islets are green and fertile. In the western and northern districts of Jutland this condition gives place to a wide expanse of moorland, covered with heather, and ending towards the sea in low whitish-grey cliffs. There is a certain charm even about these monotonous tracts, and it cannot be said that Denmark is wanting in natural beauty of a quiet order. Lakes, though small, are numerous; the largest are the Arresö and the Esromsö in Zealand, and the chain of lakes in the Himmelbjerg region, which are drained by the largest river in Denmark, the Gudenaa, which, however, has a course not exceeding 80 m. Many of the meres, overhung with thick beech-woods, are extremely beautiful. The coasts are generally low and sandy; the whole western shore of Jutland is a succession of sand ridges and shallow lagoons, very dangerous to shipping. In many places the sea has encroached; even in the 19th century entire villages were destroyed, but during the last twenty years of the century systematic efforts were made to secure the coast by groynes and embankments. A belt of sand dunes, from 500 yds. to 7 m. wide, stretches along the whole of this coast for about 200 m. Skagen, or the Skaw, a long, low, sandy point, stretches far into the northern sea, dividing the Skagerrack from the Cattegat. On the western side the coast is bolder and less inhospitable; there are several excellent havens, especially on the islands. The coast is nowhere, however, very high, except at one or two points in Jutland, and at the eastern extremity of Möen, where limestone cliffs occur.

Continental Denmark is confined wholly to Jutland, the geographical description of which is given under that heading. Out of the total area of the kingdom, 14,829 sq. m., Jutland, including the small islands adjacent to it, covers 9753 sq. m., and the insular part of the kingdom (including Bornholm), 5076 sq. m. The islands may be divided into two groups, consisting of the two principal islands Fünen and Zealand, and the lesser islands attendant on each. Fünen (Dan. *Fyen*), in form roughly an oval with an axis from S.E. to N.W. of 53 m., is separated from Jutland by a channel not half a mile wide in the north, but averaging 10 m. between the island and the Schleswig coast, and known as the Little Belt. Fünen, geologically a part of southern Jutland, has similar characteristics, a smiling landscape of fertile meadows, the typical beech-forests clothing the low hills and the presence of numerous erratic blocks, are the superficial signs of likeness. Several islands, none of great extent, lie off the west coast of Fünen in the Little Belt; off the south, however, an archipelago is enclosed by the long narrow islands of Aerö (16 m. in length) and Langeland (32 m.), including in a triangular area of shallow sea the islands of Taasinge, Avernakö, Dreiö, Turö and others. These are generally fertile and well cultivated. Aeröskjöbing and Rudkjöbing, on Aerö and Langeland respectively, are considerable ports. On Langeland is the great castle of Tranekjaer, whose record dates from the 13th century. The chief towns of Fünen itself are all coastal. Odense is the principal town, lying close to a great inlet behind the peninsula of Hindsholm on the north-east, known as Odense Fjord. Nyborg on the east is the port for the steam-ferry to Korsör in Zealand; Svendborg picturesquely overlooks the southern archipelago; Faaborg on the south-west lies on a fjord of the same name; Assens, on the west, a port for the crossing of the Little Belt into Schleswig, still shows traces of the fortifications which were stormed by John of Ranzau in 1535; Middelfart is a seaside resort near the narrowest reach of the Little Belt; Bogense is a small port on the north coast. All these towns are served by railways radiating from Odense. The strait crossed by the Nyborg-Korsör ferry is the Great Belt which divides the Fünen from the Zealand group, and is continued south by the Langelands Belt, which washes the straight eastern shore of that island, and north by the Samso Belt, named from an island 15 m. in length, with several large villages, which lies somewhat apart from the main archipelago.

Zealand, or Sealand (Dan. *Sjaelland*), measuring 82 m. N. to S. by 68 E. to W. (extremes), with its fantastic coast-line indented by fjords and projecting into long spits or promontories, may be considered as the nucleus of the kingdom, inasmuch as it contains the capital, Copenhagen, and such important towns as Roskilde, Slagelse, Korsör, Naestved and Elsinore (Helsingör). Its topography is described in detail under ZEALAND. Its attendant islands lie mainly to the south and are parts of itself, only separated by geologically recent troughs. The eastern

coast of Möen is rocky and bold. It is recorded that that island formed three separate isles in 1100, and the village of Borre, now 2 m. inland, was the object of an attack by a fleet from Lübeck in 1510. On Falster is the port of Nykjöbing, and from Gjedser, the extreme southern point of Denmark, communication is maintained with Warnemünde in Germany (29 m.). From Nykjöbing a bridge nearly one-third of a mile long crosses to Laaland, at the west of which is the port of Nakskov; the other towns are the county town of Maribo with its fine church of the 14th century, Saxkjöbing and Rödby. The island of Bornholm lies 86 m. E. of the nearest point of the archipelago, and as it belongs geologically to Sweden (from which it is distant only 22 m.) must be considered to be physically an appendage rather than an internal part of the kingdom of Denmark.

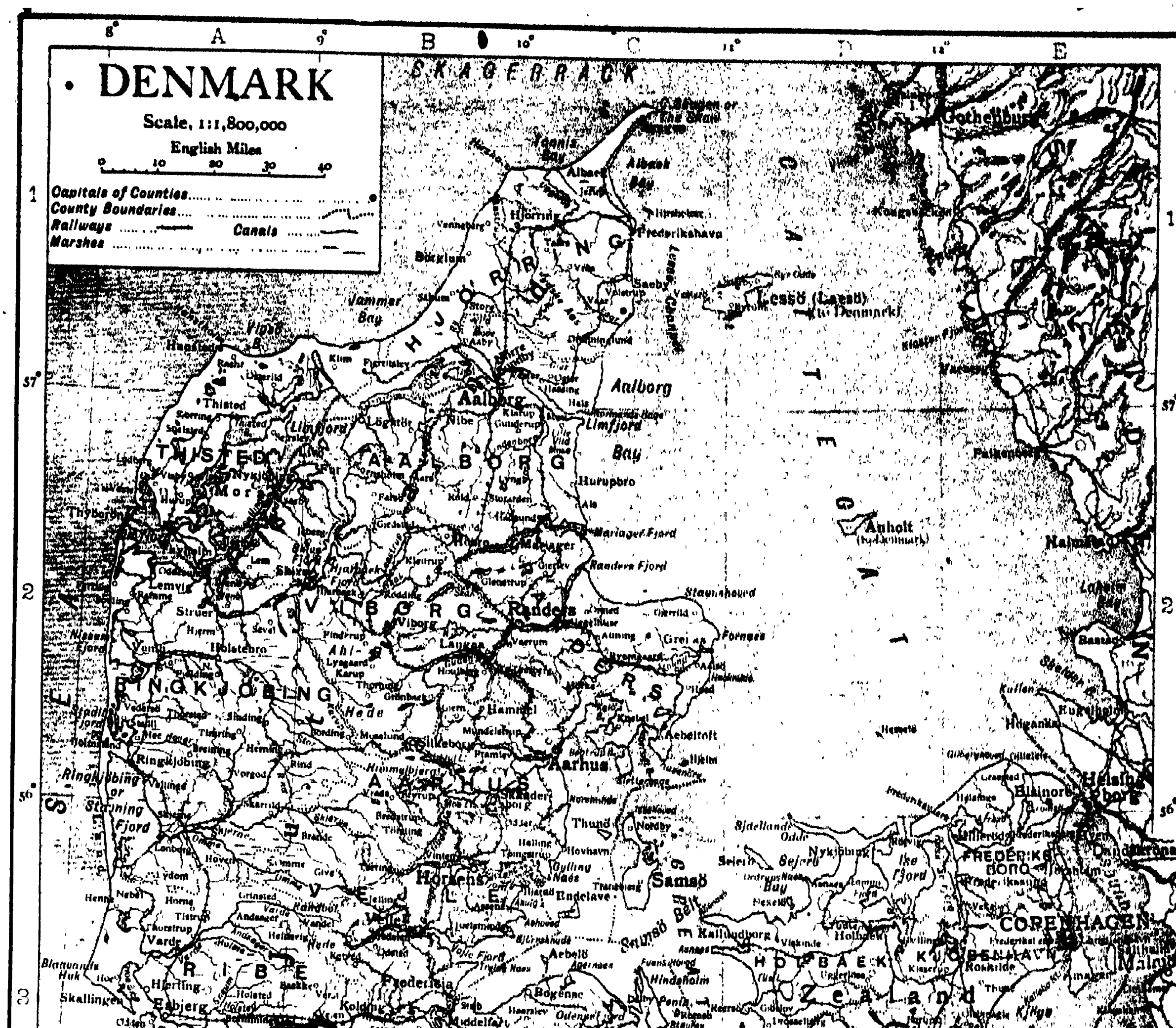
Geology.—The surface in Denmark is almost everywhere formed by the so-called Boulder Clay and what the Danish geologists call the Boulder Sand. The former, as is well known, owes its origin to the action of ice on the mountains of Norway in the Glacial period. It is unstratified; but by the action of water on it, stratified deposits have been formed, some of clay, containing remains of arctic animals, some, and very extensive ones, of sand and gravel. This boulder sand forms almost everywhere the highest hills, and besides, in the central part of Jutland, a wide expanse of heath and moorland apparently level, but really sloping gently towards the west. The deposits of the boulder formation rest generally on limestone of the Cretaceous period, which in many places comes near the surface and forms cliffs on the sea-coast. Much of the Danish chalk, including the well-known limestone of Faxe, belongs to the highest or "Danian" subdivision of the Cretaceous period. In the south-western parts a succession of strata, described as the Brown Coal or Lignite formations, intervenes between the chalk and the boulder clay; its name is derived from the deposits of lignite which occur in it. It is only on the island of Bornholm that older formations come to light. This island agrees in geological structure with the southern part of Sweden, and forms, in fact, the southernmost portion of the Scandinavian system. There the boulder clay lies immediately on the primitive rock, except in the south-western corner of the island, where a series of strata appear belonging to the Cambrian, Silurian, Jurassic and Cretaceous formations, the true Coal formation, &c., being absent. Some parts of Denmark are supposed to have been finally raised out of the sea towards the close of the Cretaceous period; but as a whole the country did not appear above the water till about the close of the Glacial period. The upheaval of the country, a movement common to a large part of the Scandinavian peninsula, still continues, though slowly, north-east of a line drawn in a south-easterly direction from Nissumfjord on the west coast of Jutland, across the island of Fyen, a little south of the town of Nyborg. Ancient sea-beaches, marked by accumulations of seaweed, rolled stones, &c., have been noticed as much as 20 ft. above the present level. But the upheaval does not seem to affect all parts equally. Even in historic times it has vastly changed the aspect and configuration of the country.

Climate, Flora, Fauna.—The climate of Denmark does not differ materially from that of Great Britain in the same latitude; but whilst the summer is a little warmer, the winter is colder, so that most of the evergreens which adorn an English garden in the winter cannot be grown in the open in Denmark. During thirty years the annual mean temperature varied from 43·88° F. to 46·22° in different years and different localities, the mean average for the whole country being 45·14°. The islands have, upon the whole, a somewhat warmer climate than Jutland. The mean temperatures of the four coldest months, December to March, are 33·26°, 31·64°, 31·82°, and 33·98° respectively, or for the whole winter 32·7°; that of the summer, June to August, 59·2°, but considerable irregularities occur. Frost occurs on an average on twenty days in each of the four winter months, but only on two days in either October or May. A fringe of ice generally lines the greater part of the Danish coasts on the eastern side for some time during the winter, and both the Sound and the Great Belt are at times impassable on account of ice. In some winters the latter is sufficiently firm and level to admit of sledges passing between Copenhagen and Malmö. The annual rainfall varies between 21·58 in. and 27·87 in. in different years and different localities. It is highest on the west coast of Jutland, while the small island of Anholt in the Cattegat has an annual rainfall of only 15·78 in. More than half the rainfall occurs from July to November, the wettest month being September, with an average of 2·95 in.; the driest month is April, with an average of 1·14 in. Thunderstorms are frequent in the summer. South-westerly winds prevail from January to March, and from September to the end of the year. In April the east wind, which is particularly searching, is predominant, while westerly winds prevail from May to August. In the district of Aalborg, in the north of Jutland, a cold and dry N.W. wind called *skaa* prevails in May and June, and is exceedingly destructive to vegetation; while along the west coast of the peninsula similar effects are produced by a salt mist, which carries its influence from 15 to 30 m. inland.

The flora of Denmark presents greater variety than might be anticipated in a country of such simple physical structure. The ordinary forms of the north of Europe grow freely in the mild air and protected soil of the islands and the eastern coast; while on the heaths and along the sandhills on the Atlantic side there flourish a number of distinctive species. The Danish forest is almost exclusively made up of beech, a tree which thrives better in Denmark than in any other country of Europe. The oak and ash are now rare, though in ancient times both were abundant in the Danish islands. The elm is also scarce. The almost universal predominance of the beech is by no means of ancient origin, for in the first half of the 17th century the oak was still the characteristic Danish tree. No conifer grows in Denmark except under careful cultivation, which, however, is largely practised in Jutland (*q.v.*). But again, abundant traces of ancient extensive forests of fir and pine are found in the numerous peat bogs which supply a large proportion of the fuel locally used. In Bornholm, it should be mentioned, the flora is more like that of Sweden; not the beech, but the pine, birch and ash are the most abundant trees.

The wild animals and birds of Denmark are those of the rest of central Europe. The larger quadrupeds are all extinct; even the red deer, formerly so abundant that in a single hunt in Jutland in 1593 no less than 1600 head of deer were killed, is now only to be met with in preserves. In the prehistoric "kitchen-middens" (*kjökkenmödding*) and elsewhere, however, vestiges are found which prove that the urochs, the wild boar, the beaver, the bear and the wolf all existed subsequently to the arrival of man. The usual domestic animals are abundantly found in Denmark, with the exception of the goat, which is uncommon. The sea fisheries are of importance. Oysters are found in some places, but have disappeared from many localities, where their abundance in ancient times is proved by their shell moulds on the coast. The Gudenaa is the only salmon river in Denmark.

Population.—The population of Denmark in 1901 was 2,449,540. It was 929,001 in 1801, showing an increase during the century in the proportion of 1 to 2·63. In 1901 the average density of the population of Denmark was 165·2 to the square mile, but varied much in the different parts. Jutland showed an average of only 109 inhabitants per square mile, whilst on the islands, which had a total population of 1,385,537, the average stood at 272·95, owing, on the one hand, to the fact that large tracts in the interior of Jutland are almost uninhabited, and on the other to the fact that the capital of the country, with its proportionately large population, is situated on the island of Zealand. The percentages of urban and rural population are respectively about 38 and 62. A notable movement of the population to the towns began about the middle of the 19th century, and increased until very near its end. It was stronger on the islands, where the rural population increased by 5·3 % only in eleven years, whereas in Jutland the increase of the rural population between 1890 and 1901 amounted to 12·0 %. Here, however, peculiar circumstances contributed to the increase, as successful efforts have been made to render the land fruitful by artificial means. The


DENMARK
Scale, 1:1,800,000
English Miles
0 10 20 30 40
Capitals of Counties
County Boundaries
Railways
Canals
Marshes
SKAGERRACK
Aalborg
Randers
Viborg
Thisted
Horsens
Samsö
Kolding
Fredericia
Odense
Svendborg
Flensburg
Schleswig
Kiel
Rendsburg
Neumünster
Lübeck
Wismar
Fehmarn
COPENHAGEN
Sylt
Amrum
Ringkjöbing
Holstebro
Lemvig
Skive
Aarhus
Anholt
Vordingborg
Nakskov
Möen
BORNHOLM
Same Scale
Longitude East 10° of Greenwich

Danes are a yellow-haired and blue-eyed Teutonic race of middle stature, bearing traces of their kinship with the northern Scandinavian peoples. Their habits of life resemble those of the North Germans even more than those of the Swedes. The independent tenure of the land by a vast number of small farmers, who are their own masters, gives an air of carelessness, almost of truculence, to the well-to-do Danish peasants. They are generally slow of speech and manner, and somewhat irresolute, but take an eager interest in current politics, and are generally fairly educated men of extreme democratic principles. The result of a fairly equal distribution of wealth is a marked tendency towards equality in social intercourse. The townspeople show a bias in favour of French habits and fashions. The separation from the duchies of Schleswig and Holstein, which were more than half German, intensified the national character; the Danes are intensely patriotic; and there is no portion of the Danish dominions except perhaps in the West Indian islands, where a Scandinavian language is not spoken. The preponderance of the female population over the male is approximately as 1052 to 1000. The male sex remains in excess until about the twentieth year, from which age the female sex preponderates in increasing ratio with advancing age. The percentage of illegitimacy is high as a whole, although in some of the rural districts it is very low. But in Copenhagen 20 % of the births are illegitimate. Between the middle and the end of the 19th century the rate of mortality decreased most markedly for all ages. During the last decade of the century it ranged between 19·5 per thousand in 1891 and 15·1 in 1898 (17·4 in 1900). Emigration for some time in the 19th century at different periods, both in its early part and towards its close, seriously affected the population of Denmark. But in the last decade it greatly diminished. Thus in 1892 the number of emigrants to Transatlantic places rose to 10,422 but in 1900 it was only 3570. The great bulk of them go to the United States; next in favour is Canada.

Communications.—The roads of Denmark form an extensive and well-maintained system. The railway system is also fairly complete, the state owning about three-fifths of the total mileage, which amounts to some 2000. Two lines enter Denmark from Schleswig across the frontier. The main Danish lines are as follows. From the frontier a line runs east by Fredericia, across the island of Fünen by Odense and Nyborg, to Korsör on Zealand, and thence by Roskilde to Copenhagen. The straits between Fredericia and Middelfart and between Nyborg and Korsör are crossed by powerful steam-ferries which are generally capable of conveying a limited number of railway wagons. This system is also in use on the line which runs south from Roskilde to the island of Falster, from the southernmost point of which, Gjedser, ferry-steamers taking railway cars serve Warnemünde in Germany. The main lines in Jutland run (*a*) along the eastern side north from Fredericia by Horsens, Aarhus, Randers, Aalborg and Hjörring, to Frederikshavn, and (*b*) along the western side from Esbjerg by Skjerne and Vemb, and thence across the peninsula by Viborg to Langaa on the eastern line. The lines are generally of standard gauge (4ft. 8½ in.), but there is also a considerable mileage of light narrow-gauge railways. Besides the numerous steam-ferries which connect island and island, and Jutland with the islands, and the Gjedser-Warnemünde route, a favourite passenger line from Germany is that between Kiel and Korsör, while most of the German Baltic ports have direct connexion with Copenhagen. With Sweden communications are established by ferries across the Sound between Copenhagen and Malmö and Landskrona, and between Elsinore (Helsingör) and Helsingborg. The postal department maintains a telegraph and telephone service.

Industries.—The main source of wealth in Denmark is agriculture, which employs about two-fifths of the entire population. Most of the land is freehold and cultivated by the owner himself, and comparatively little land is let on lease except very large holdings and glebe farms. The independent small farmer (*bönder*) maintains a hereditary attachment to his ancestral holding. There is also a class of cottar freeholders (*junster*). Fully 74 % of the total area of the country is agricultural land. Of this only about one-twelfth is meadow land. The land under grain crops is not far short of one-half the remainder, the principal crops being oats, followed by barley and rye in about equal quantities, with wheat about one-sixth that of barley and hardly one-tenth that of oats. Beet is extensively grown. During the last forty years of the 19th century dairy-farming was greatly developed in Denmark, and brought to a high degree of perfection by the application of scientific methods and the best machinery, as well as by the establishment of joint dairies. The Danish government has assisted this development by granting money for experiments and by a rigorous system of inspection for the prevention of adulteration. The co-operative system plays an important part in the industries of butter-making, poultry-farming and the rearing of swine.

Rabbits, which are not found wild in Denmark, are bred for export. Woods cover fully 7 % of the area, and their preservation is considered of so much importance that private owners are under strict control as regards cutting of timber. The woods consist mostly of beech, which is principally used for fuel, but pines were extensively planted during the 19th century. Allusion has been made already to the efforts to plant the extensive heaths in Jutland (*q.v.*) with pine-trees.

Agriculture.—Rates and taxes on land are mostly levied according to a uniform system of assessment, the unit of which is called a *Tonde Hartkorn*. The Td. Htk., as it is usually abbreviated, has further subdivision, and is intended to correspond to the same value of land throughout the country. The Danish measure for land is a *Tonde Land* (Td. L.), which is equal to 1·363 statute acres. Of the best ploughing land a little over 6 Td. L., or about 8 acres, go to a Td. Htk., but of unprofitable land a Td. Htk. may represent 300 acres or more. On the islands and in the more fertile part of Jutland the average is about 10 Td. L., or 13½ acres. Woodland, tithes, &c., are also assessed to Td. Htk. for fiscal purposes. In the island of Bornholm, the assessment is somewhat different, though the general state of agricultural holdings is the same as in other parts. The selling value of land has shown a decrease in modern times on account of the agricultural depression. A homestead with land assessed less than 1 Td. Htk. is legally called a *Huus* or *Sted*, *i.e.* cottage, whilst a farm assessed at 1 Td. Htk. or more is called *Gaard*, *i.e.* farm. Farms of between 1 and 12 Td. Htk. are called *Bondergaarde*, or peasant farms, and are subject to the restriction that such a holding cannot lawfully be joined to or entirely merged into another. They may be subdivided, and portions may be added to another holding, but the homestead, with a certain amount of land, must be preserved as a separate holding for ever. The seats of the nobility and landed gentry are called *Herregaarde*. The peasants hold about 73 % of all the land according to its value. As regards their size about 30 % are assessed from 1 to 4 Td. Htk.; about 33 % from 4 to 8 Td. Htk.; the remainder at about 8 Td. Htk. An annual sum is voted by parliament out of which loans are granted to cottagers who desire to purchase small freehold plots.

The fishery along the coasts of Denmark is of some importance both on account of the supply of food obtained thereby for the population of the country, and on account of the export; but the good fishing grounds, not far from the Danish coast, particularly in the North Sea, are mostly worked by the fishing vessels of other nations, which are so numerous that the Danish government is obliged to keep gun-boats stationed there in order to prevent encroachments on territorial waters.

Other Industries.—The mineral products of Denmark are unimportant. It is one of the poorest countries of Europe in this particular. It is rich, however, in clays, while in the island of Bornholm there are quarries of freestone and marble. The factories of Denmark supply mainly local needs. The largest are those engaged in the construction of engines nd iron ships. The manufacture of woollens and cotton, the domestic manufacture of linen in Zealand, sugar refineries, paper mills, breweries, and distilleries may also be mentioned. The most notable manufacture is that of porcelain. The nucleus of this industry was a factory started in 1772, by F. H. Müller, for the making of china out of Bornholm clay. In 1779 it passed into the hands of the

state, and has remained there ever since, though there are also private factories. Originally the Copenhagen potters imitated the Dresden china made at Meissen, but they later produced graceful original designs. The creations of Thorvaldsen have been largely repeated and imitated in this ware. Trade-unionism flourishes in Denmark, and strikes are of frequent occurrence.

Commerce.—Formerly the commercial legislation of Denmark was to such a degree restrictive that imported manufactures had to be delivered to the customs, where they were sold by public auction, the proceeds of which the importer received from the custom-houses after a deduction was made for the duty. To this restriction, as regards foreign intercourse, was added a no less injurious system of inland duties impeding the commerce of the different provinces with each other. The want of roads also, and many other disadvantages, tended to keep down the development of both commerce and industry. During the 19th century, however, several commercial treaties were concluded between Denmark and the other powers of Europe, which made the Danish tariff more regular and liberal.

The vexed question, of many centuries' standing, concerning the claim of Denmark to levy dues on vessels passing through the Sound (*q.v.*), was settled by the abolition of the dues in 1857. The commerce of Denmark is mainly based on home production and home consumption, but a certain quantity of goods is imported with a view to re-exportation, for which the free port and bonded warehouses at Copenhagen give facilities. In modern times the value of Danish commerce greatly increased, being doubled in the last twenty years of the 19th century, and exceeding a total of fifty millions sterling. The value of export is exceeded as a whole by that of import in the proportion, roughly, of 1 to 1·35. By far the most important articles of export may be classified as articles of food of animal origin, a group which covers the vast export trade in the dairy produce, especially butter, for which Denmark is famous. The value of the butter for export reaches nearly 40 % of the total value of Danish exports. A small proportion of the whole is imported chiefly from Russia (also Siberia) and Sweden and re-exported as of foreign origin. The production of margarine is large, but not much is exported, margarine being largely consumed in Denmark instead of the butter, which is exported. Next to butter the most important article of Danish export is bacon, and huge quantities of eggs are also exported. Exports of less value, but worthy of special notice, are vegetables and wool, bones and tallow, also dairy machinery, and finally cement, the production of which is a growing industry. The classes of articles of food of animal origin, and living animals, are the only ones of which the exportation exceeds the importation; with regard to all other goods, the reverse is the case. In the second of these classes the most important export is home-bred horned cattle. The trade in live sheep and swine, which was formerly important, has mostly been converted into a dead-meat trade. A proportionally large importation of timber is caused by the scarcity of native timber suitable for building purposes, the plantations of firs and pines being insufficient to produce the quantity required, and the quality of the wood being inferior beyond the age of about forty years. The large importation of coal, minerals and metals, and goods made from them is likewise caused by the natural poverty of the country in these respects.

Denmark carries on its principal import trade with Germany, Great Britain and the United States of America, in this order, the proportions being about 30, 20 and 16 % respectively of the total. Its principal export trade is with Great Britain, Germany and Sweden, the percentage of the whole being 60, 18 and 10. With Russia, Norway and France (in this order) general trade is less important, but still large. A considerable proportion of Denmark's large commercial fleet is engaged in the carrying trade between foreign, especially British, ports.

Under a law of the 4th of May 1907 it was enacted that the metric system of weights and measures should come into official use in three years from that date, and into general use in five years.

Money and Banking.—The unit of the Danish monetary system, as of the Swedish and Norwegian, is the *krone* (crown), equal to 1s. 1⅛d., which is divided into 100 *öre*; consequently 7⅞ öre are equal to one penny. Since 1873 gold has been the standard, and gold pieces of 20 and 10 kroner are coined, but not often met with, as the public prefers bank-notes. The principal bank is the National Bank at Copenhagen, which is the only one authorized to issue notes. These are of the value of 10, 50, 100 and 500 kr. Next in importance are the Danske Landmands Bank, the Handels Bank and the Private Bank, all at Copenhagen. The provincial banks are very numerous; many of them are at the same time savings banks. Their rate of interest, with few exceptions, is 3½ to 4 %. There exist, besides, in Denmark several mutual loan associations (*Kreditforeninger*), whose business is the granting of loans on mortgage. Registration of mortgages is compulsory in Denmark, and the system is extremely simple, a fact which has been of the greatest importance for the improvement of the country. There are comparatively large institutions for insurance of all kinds in Denmark. The largest office for life insurance is a state institution. By law of the 9th of April 1891 a system of old-age pensions was established for the benefit of persons over sixty years of age.

Government.—Denmark is a limited monarchy, according to the law of 1849, revised in 1866. The king shares his power with the parliament (*Rigsdag*), which consists of two chambers, the *Landsthing* and the *Folkething*, but the constitution contains no indication of any difference in their attributes. The Landsthing, or upper house, however, is evidently intended to form the conservative element in the constitutional machinery. While the 114 members of the Folkething (House of Commons) are elected for three years in the usual way by universal suffrage, 12 out of the 66 members of the Landsthing are life members nominated by the crown. The remaining 54 members of the Landsthing are returned for eight years according to a method of proportionate representation by a body of deputy electors. Of these deputies one-half are elected in the same way as members of the Folkething, without any property qualification for the voters; the other half of the deputy electors are chosen in the towns by those who during the last preceding year were assessed on a certain minimum of income, or paid at least a certain amount in rates and taxes. In the rural districts the deputy electors returned by election are supplemented by an equal number of those who have paid the highest amounts in taxes and county rates together. In this manner a representation is secured for fairly large minorities, and what is considered a fair share of influence on public affairs given to those who contribute the most to the needs of the state. The franchise is held by every male who has reached his thirtieth year, subject to independence of public charity and certain other circumstances. A candidate for either house of the Rigsdag must have passed the age of twenty-five. Members are paid ten kroner each day of the session and are allowed travelling expenses. The houses meet each year on the first Monday in October. The constitutional theory of the Folkething is that of one member for every 16,000 inhabitants. The Faeröe islands, which form an integral part of the kingdom of Denmark in the wider sense, are represented in the Danish parliament, but not the other dependencies of the Danish crown, namely Iceland, Greenland and the West Indian islands of St Thomas, St John and St Croix. The budget is considered by the Folkething at the beginning of each session. The revenue and expenditure average annually about £4,700,000. The principal items of revenue are customs and excise, land and house tax, stamps, railways, legal fees, the state lottery and death duties. A considerable reserve fund is maintained to meet emergencies. The public debt is about £13,500,000 and is divided into an internal debt, bearing interest generally at 3½ %, and a foreign debt (the larger), with interest generally at 3 %. The revenue and expenditure of the Faeröes are included in the budget for Denmark proper, but Iceland and the West Indies have their separate budgets. The Danish treasury receives nothing from these possessions; on the contrary, Iceland receives an annual grant, and the West Indian islands have been heavily subsidized by the Danish finances to

assist the sugar industry. The administration of Greenland (*q.v.*) entails an annual loss which is posted on the budget of the ministry of finances. The state council (*Statsraad*) includes the presidency of the council and ministries of war, and marine, foreign affairs, the interior, justice, finance, public institution and ecclesiastical, agriculture and public works.

Local Government.—For administrative purposes the country is divided into eighteen counties (*Amter*, singular *Amt*), as follows. (1) Covering the islands of Zealand and lesser adjacent islands, Copenhagen, Frederiksborg, Holbaek, Sorö, Praesto. (2) Covering the islands of Laaland and Falster, Maribe. (3) Covering Fünen, Langeland and adjacent islets, Svenborg, Odense. (4) On the mainland, Hjörring, Aalborg, Thisted, Ringkjöbing, Viborg, Randers, Aarhus, Vejle, Ribe. (5) Bornholm. The principal civil officer in each of these is the *Amtmand*. Local affairs are managed by the *Amtsraad* and *Sogneraad*, corresponding to the English county council and parish council. These institutions date from 1841, but they have undergone several modifications since. The members of these councils are elected on a system similar to that applied to the elections for the Landsthing. The same is the case with the provincial town councils. That of Copenhagen is elected by those who are rated on an income of at least 400 kroner (£22). The burgomasters are appointed by the crown, except at Copenhagen, where they are elected by the town council, subject to royal approbation. The financial position of the municipalities in Denmark is generally good. The ordinary budget of Copenhagen amounts to about £1,100,000 a year.

Justice.—For the administration of justice Denmark is divided into *herreds* or hundreds; as, however, they are mostly of small extent, several are generally served by one judge (*herredsfoged*); the townships are likewise separate jurisdictions, each with a *byfoged*. There are 126 such local judges, each of whom deals with all kinds of cases arising in his district, and is also at the head of the police. There are two intermediary Courts of Appeal (*Overret*), one in Copenhagen, another in Viborg; the Supreme Court of Appeal (*Höjesteret*) sits at Copenhagen. In the capital the different functions are more divided. There is also a Court of Commerce and Navigation, on which leading members of the trading community serve as assessors. In the country, Land Commissions similarly constituted deal with many questions affecting agricultural holdings. A peculiarity of the Danish system is that, with few exceptions, no civil cause can be brought before a court until an attempt has been made at effecting an amicable settlement. This is mostly done by so-called Committees of Conciliation, but in some cases by the court itself before commencing formal judicial proceedings. In this manner three-fifths of all the causes are settled, and many which remain unsettled are abandoned by the plaintiffs. Sanitary matters are under the control of a Board of Health. The whole country is divided into districts, in each of which a medical man is appointed with a salary, who is under the obligation to attend to poor sick and assist the authorities in medical matters, inquests, &c. The relief of the poor is well organized, mostly on the system of out-door relief. Many workhouses have been established for indigent persons capable of work. There are also many almshouses and similar institutions.

Army and Navy.—The active army consists of a life guard battalion and 10 infantry regiments of 3 battalions each, infantry, 5 cavalry regiments of 3 squadrons each, 12 field batteries (now re-armed with a Krupp Q.F. equipment), 3 battalions of fortress artillery and 6 companies of engineers, with in addition various local troops and details. The peace strength of permanent troops, without the annual contingent of recruits, is about 13,500 officers and men, the annual contingent of men trained two or three years with the colours about 22,500, and the annual contingent of special reservists (men trained for brief periods) about 17,000. Thus the number of men maintained under arms (without calling up the reserves) is as high as 75,000 during certain periods of the year and averages nearly 60,000. Reservists who have definitively left the colours are recalled for short refresher trainings, the number of men so trained in 1907 being about 80,000. The field army on a war footing, without depot troops, garrison troops and reservists, would be about 50,000 strong, but by constituting new cadres at the outbreak of war and calling up the reserves it could be more than doubled, and as a matter of fact nearly 120,000 men were with the colours in the manœuvre season in 1907. The term of service is eight years in the active army and its reserves and eight years in the second line. The armament of the infantry is the Krag-jorgensen of ·314 in. calibre, model 1889, that of the field artillery a 7·5 cm. Krupp Q.F. equipment, model 1902. The navy consists of 6 small battleships, 3 coast defence armour-clads, 5 protected cruisers, 5 gun-boats, and 24 torpedo craft.

Religion.—The national or state church of Denmark is officially styled "Evangelically Reformed," but is popularly described as Lutheran. The king must belong to it. There is complete religious toleration, but though most of the important Christian communities are represented their numbers are very small. The Mormon apostles for a considerable time made a special raid upon the Danish peasantry and a few hundreds profess this faith. There are seven dioceses, Fünen, Laaland and Falster, Aarhus, Aalborg, Viborg and Ribe, while the primate is the bishop of Zealand, and resides at Copenhagen, but his cathedral is at Roskilde. The bishops have no political function by reason of their office, although they may, and often do, take a prominent part in politics. The greater part of the pastorates comprise more than one parish. The benefices are almost without exception provided with good residences and glebes, and the tithes, &c., generally afford a comfortable income. The bishops have fixed salaries in lieu of tithes appropriated by the state.

Education and Arts.—The educational system of Denmark is maintained at a high standard. The instruction in primary schools is gratuitous. Every child is bound to attend the parish school at least from the seventh to the thirteenth year, unless the parents can prove that it receives suitable instruction in other ways. The schools are under the immediate control of school boards appointed by the parish councils, but of which the incumbent of the parish is *ex-officio* member; superior control is exercised by the Amtmand, the rural dean, and the bishop, under the Minister for church and education. Secondary public schools are provided in towns, in which moderate school fees are paid. There are also public grammar-schools. Nearly all schools are day-schools. There are only two public schools, which, though on a much smaller scale, resemble the great English schools, namely, those of Sorö and Herlufsholm, both founded by private munificence. Private schools are generally under a varying measure of public control. The university is at Copenhagen (*q.v.*). Amongst numerous other institutions for the furtherance of science and training of various kinds may be mentioned the large polytechnic schools; the high school for agriculture and veterinary art; the royal library; the royal society of sciences; the museum of northern antiquities; the society of northern antiquaries, &c. The art museums of Denmark are not considerable, except the museum of Thorvaldsen, at Copenhagen, but much is done to provide first-rate training in the fine arts and their application to industry through the Royal Academy of Arts, and its schools. Finally, it may be mentioned that a sum proportionately large is available from public funds and regular parliamentary grants for furthering science and arts by temporary subventions to students, authors, artists and others of insufficient means, in order to enable them to carry out particular works, to profit by foreign travel, &c. The principal scientific societies and institutions are detailed under COPENHAGEN. During the earlier part of the 19th century not a few men could be mentioned who enjoyed an exceptional reputation in various departments of science, and Danish scientists continue to contribute their full share to the advancement of knowledge. The society of sciences, that of northern antiquaries, the natural history and the botanical societies, &c., publish their transactions and proceedings, but the *Naturhistorisk Tidsskrift*, of which 14 volumes with 259 plates were published (1861–1884), and which was in the foremost rank in its department, ceased with the death in 1884 of the editor, the distinguished zoologist, I. C. Schiödte.

Another extremely valuable publication of wide general interest, the *Meddelelser om Grönland*, is published by the commission for the exploration of Greenland. What may be called the modern "art" current, with its virtues and vices, is as strong in Denmark as in England. Danish sculpture will be always famous, if only through the name of Thorvaldsen. In architecture the prevailing fashion is a return to the style of the first half of the 17th century, called the Christian IV. style; but in this branch of art no marked excellence has been obtained.

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(C. A. G.; O. J. R. H.)

HISTORY

Ancient.—Our earliest knowledge of Denmark is derived from Pliny, who speaks of three islands named "Skandiai," a name which is also applied to Sweden. He says nothing about the inhabitants of these islands, but tells us more about the Jutish peninsula, or Cimbric Chersonese as he calls it. He places the Saxons on the neck, above them the Sigoulones, Sabaliggoi and Kobandoi, then the Chaloi, then above them the Phoundousioi, then the Charondes and finally the Kimbroi. He also mentions the three islands called Alokiai, at the northern end of the peninsula. This would point to the fact that the Limfjord was then open at both ends, and agree with Adam of Bremen (iv. 16), who also speaks of three islands called Wendila, Morse and Thud. The Cimbri and Charydes are mentioned in the *Monumentum Ancyranum* as sending embassies to Augustus in A.D. 5. The Promontorium Cimbrorum is spoken of in Pliny, who says that the Sinus Codanus lies between it and Mons Saevo. The latter place is probably to be found in the high-lying land on the N.E. coast of Germany, and the Sinus Codanus must be the S.W. corner of the Baltic, and not the whole sea. Pomponius Mela says that the Cimbri and Teutones dwelt on the Sinus Codanus, the latter also in Scandinavia (or Sweden). The Romans believed that these Cimbri and Teutones were the same as those who invaded Gaul and Italy at the end of the 2nd century B.C. The Cimbri may probably be traced in the province of Aalborg, formerly known as Himmerland; the Teutones, with less certainty, may be placed in Thyth or Thyland, north of the Limfjord. No further reference to these districts is found till towards the close of the migration period, about the beginning of the 6th century, when the Heruli (*q.v.*), a nation dwelling in or near the basin of the Elbe, were overthrown by the Langobardi. According to Procopius (*Bellum Gothicum*, ii. 15), a part of them made their way across the "desert of the Slavs," through the lands of the Warni and the Danes to Thoule (*i.e.* Sweden). This is the first recorded use of the name "Danes." It occurs again in Gregory of Tours (*Historiae Francorum*, iii. 3) in connexion with an irruption of a Götish (loosely called Danish) fleet into the Netherlands (*c.* 520). From this time the use of the name is fairly common. The heroic poetry of the Anglo-Saxons may carry the name further back, though probably it is not very ancient, at all events on the mainland.

According to late Danish tradition Denmark now consisted of Vitheslaeth (*i.e.* Zealand, Möen, Falster and Laaland), Jutland (with Fyen) and Skaane. Jutland was acquired by Dan, the eponymous ancestor of the Danes. He also won Skaane, including the modern provinces of Halland, Kristianstad, Malmöhus and Blekinge, and these remained part of Denmark until the middle of the 17th century. These three divisions always remained more or less distinct, and the Danish kings had to be recognized at Lund, Ringsted and Viborg, but Zealand was from time immemorial the centre of government, and Lejre was the royal seat and national sanctuary. According to tradition this dates from the time of Skiöldr, the eponymous ancestor of the Danish royal family of Skiöldungar. He was a son of Othin and husband of the goddess Gefjon, who created Zealand. Anglo-Saxon tradition also speaks of Scyld (*i.e.* Skiöldr), who was regarded as the ancestor of both the Danish and English royal families, and it represented him as coming as a child of unknown origin in a rudderless boat. There can be little doubt that from a remote antiquity Zealand had been a religious sanctuary, and very probably the god Nerthus was worshipped here by the Angli and other tribes as described in Tacitus (*Germania*, *c.* 40). The Lejre sanctuary was still in existence in the time of Thietmar of Merseburg (i. 9), at the beginning of the 11th century.

In Scandinavian tradition the next great figure is Fróðe the peace-king, but it is not before the 5th century that we meet with the names of any kings which can be regarded as definitely historical. In *Beowulf* we hear of a Danish king Healfdene, who had three sons, Heorogar, Hrothgar and Halga. The hero Beowulf comes to the court of Hrothgar from the land of the Götar, where Hygelac is king. This Hygelac is undoubtedly to be identified with the Chochilaicus, king of the Danes (really Götar) who, as mentioned above, made a raid against the Franks *c.* 520. Beowulf himself won fame in this campaign, and by the aid of this definite chronological datum we can place the reign of Healfdene in the last half of the 5th century, and that of Hrothgar's nephew Hrothwulf, son of Halga, about the middle of the 6th century. Hrothgar and Halga correspond to Saxo's Hroar and Helgi, while Hrothwulf is the famous Rolvo or Hrólfr Kraki of Danish and Norse saga. There is probably some historical truth in the story that Heoroweard or Hiörvarðr was responsible for the death of Hrólfr Kraki. Possibly a still earlier king of Denmark was Sigarr or Sigehere, who has won lasting fame from the story of his daughter Signy and her lover Hagbarðr.

From the middle of the 6th to the beginning of the 8th century we know practically nothing of Danish history. There are numerous kings mentioned in Saxo, but it is impossible to identify them historically. We have mention at the beginning of the 8th century of a Danish king Ongendus (cf. O. E. Ongenþeow) who received a mission led by St Willibrord, and it was probably about this time that there flourished a family of whom tradition records a good deal. The founder of this line was Ivarr Viðfaðmi of Skaane, who became king of Sweden. His daughter Auðr married one Hroerekr and became the mother of Haraldr Hilditönn. The genealogy of Haraldr is given differently in Saxo, but there can be no doubt of his historical existence. In his time it is said that the land was divided into four kingdoms—Skaane, Zealand, Fyen and Jutland. After a reign of great splendour Haraldr met his death in the great battle of Bråvalla (Bravik in Östergötland), where he was opposed by his nephew Ring, king of Sweden.

The battle probably took place about the year 750. Fifty years later the Danes begin to be mentioned with comparative frequency in continental annals. From 777–798 we have mention of a certain Sigifridus as king of the Danes, and then in 804 his name is replaced by that of one Godefridus. This Godefridus is the Godefridus-Guthredus of Saxo, and is to be identified also with Guðröðr the Yngling, king in Vestfold in Norway. He came into conflict with Charlemagne, and was preparing a great expedition against him when he was killed by one of his own followers (*c.* 810). He was succeeded by his brother Hemmingus, but the latter died in 812 and there was a disputed succession. The two claimants were "Sigefridus nepos Godefridi regis" and "Anulo nepos Herioldi quondam regis" (*i.e.* probably Haraldr Hilditönn). A great battle took place in which both claimants were slain, but the party of Anulo (O.N. Áli) were victorious and appointed as kings Anulo's brothers Herioldus and Reginfridus. They soon paid a visit to Vestfold, "the extreme district of their realm, whose peoples and chief men were refusing to be made subject to them," and on their return had trouble with the sons of Godefridus. The latter expelled them from their kingdom, and in 814 Reginfridus fell in a vain attempt to regain it. Herioldus now received the support of the emperor,

and after several unsuccessful attempts a compromise was effected in 819 when the parties agreed to share the realm. In 820 Herioldus was baptized at Mainz and received from the emperor a grant of Riustringen in N.E. Friesland. In 827 he was expelled from his kingdom, but St Anskar, who had been sent with Herioldus to preach Christianity, remained at his post. In 836 we find one Horic as king of the Danes; he was probably a son of Godefridus. During his reign there was trouble with the emperor as to the overlordship of Frisia. In the meantime Herioldus remained on friendly terms with Lothair and received a further grant of Walcheren and the neighbouring districts. In 850 Horic was attacked by his own nephews and compelled to share the kingdom with them, while in 852 Herioldus was charged with treachery and slain by the Franks. In 854 a revolution took place in Denmark itself. Horic's nephew Godwin, returning from exile with a large following of Northmen, overthrew his uncle in a three days' battle in which all members of the royal house except one boy are said to have perished. This boy now became king as "Horicus junior." Of his reign we know practically nothing. The next kings mentioned are Sigafrid and Halfdane, who were sons of the great Viking leader Ragnarr Lodbrok. There is also mention of a third king named Godefridus. The exact chronology and relationship of these kings it is impossible to determine, but we know that Healfdene died in Scotland in 877, while Godefridus was treacherously slain by Henry of Saxony in 885. During these and the next few years there is mention of more than one king of the names Sigefridus and Godefridus: the most important event associated with their names is that two kings Sigefridus and Godefridus fell in the great battle on the Dyle in 891.

We now have the names of several kings, Heiligo, Olaph (of Swedish origin), and his sons Chnob and Gurth. Then come a Danish ruler Sigeric, followed by Hardegon, son of Swein, coming from Norway. At some date after 916 we find mention of one "Hardecnuth Urm" ruling among the Danes. Adam of Bremen, from whom these details come, was himself uncertain whether "so many kings or rather tyrants of the Danes ruled together or succeeded one another at short intervals." Hardecnuth Urm is to be identified with the famous Gorm the old, who married Thyra Danmarkarbót: their son was Harold Bluetooth.

(A. Mw.)

Medieval and Modern.—Danish history first becomes authentic at the beginning of the 9th century. The Danes, the southernmost branch of the Scandinavian family, referred to by Alfred (*c.* 890) as occupying Jutland, the islands and Scania, were, in 777, strong enough to defy the Frank empire by harbouring its fugitives. Five years later we find a Danish king, Sigfrid, among the princes who assembled at Lippe in 782 to make their submission to Charles the Great. About the same time Willibrord, from his see at Utrecht, made an unsuccessful attempt to convert the "wild Danes." These three salient facts are practically the sum of our knowledge of early Danish history previous to the Viking period. That mysterious upheaval, most generally attributed to a love of adventure, stimulated by the pressure of over-population, began with the ravaging of Lindisfarne in 793, and virtually terminated with the establishment of Rollo in Normandy (911). There can be little doubt that the earlier of these expeditions were from Denmark, though the term Northmen was originally applied indiscriminately to all these terrible visitants from the unknown north. The rovers who first chastened and finally colonized southern England and Normandy were certainly Danes.

The Viking raids were one of the determining causes of the establishment of the feudal monarchies of western Europe, but the untameable freebooters were themselves finally subdued by the Church. At first sight it seems curious that Christianity should have been so slow to reach Denmark. But we must bear in mind that one very important consequence of the Viking raids was to annihilate the geographical remoteness which had hitherto separated Denmark from the Christian world. Previously to 793 there lay between Jutland and England a sea which no keel had traversed within the memory of man. The few and peaceful traders who explored those northern waters were careful never to lose sight of the Saxon, Frisian and Frankish shores during their passage. Nor was communication with the west by land any easier. For generations the obstinately heathen Saxons had lain, a compact and impenetrable mass, between Scandinavia and the Frank empire, nor were the measures adopted by Charles the Great for the conversion of the Saxons to the true faith very much to the liking of their warlike Danish neighbours on the other side. But by the time that Charles had succeeded in "converting" the Saxons, the Viking raids were already at their height, and though generally triumphant, necessity occasionally taught the Northmen the value of concessions. Thus it was the desire to secure his Jutish kingdom which induced Harold Klak, in 826, to sail up the Rhine to Ingelheim, and there accept baptism, with his wife, his son Godfred and 400 of his suite, acknowledging the emperor as his overlord, and taking back with him to Denmark the missionary monk Ansgar. Ansgar preached in Denmark from 826 to 861, but it was not till after the subsidence of the Viking raids that Adaldag, archbishop of Hamburg, could open a new and successful mission, which resulted in the erection of the bishoprics of Schleswig, Ribe and Aarhus (*c.* 948), though the real conversion of Denmark must be dated from the baptism of King Harold Bluetooth (960).

Conversion of the Danes.

Meanwhile the Danish monarchy was attempting to aggrandize itself at the expense of the Germans, the Wends who then occupied the Baltic littoral as far as the Vistula, and the other Scandinavian kingdoms. Harold Bluetooth (940–986) subdued German territory south of the Eider, extended the *Danevirke*, Denmark's great line of defensive fortifications, to the south of Schleswig and planted the military colony of Julin or Jomsborg, at the mouth of the Oder. Part of Norway was first seized after the united Danes and Swedes had defeated and slain King Olaf Trygvessön at the battle of Svolde (1000); and between 1028 and 1035 Canute the Great added the whole kingdom to his own; but the union did not long survive him. Equally short-lived was the Danish dominion in England, which originated in a great Viking expedition of King Sweyn I.

Danish expansion.

The period between the death of Canute the Great and the accession of Valdemar I. was a troublous time for Denmark. The kingdom was harassed almost incessantly, and more than once partitioned, by pretenders to the throne, who did not scruple to invoke the interference of the neighbouring monarchs, and even of the heathen Wends, who established themselves for a time on the southern islands. Yet, throughout this chaos, one thing made for future stability, and that was the growth and consolidation of a national church, which culminated in the erection of the archbishopric of Lund (*c.* 1104) and the consequent ecclesiastical independence of Denmark. The third archbishop of Lund was Absalon (1128–1201), Denmark's first great statesman, who so materially assisted Valdemar I. (1157–1182) and Canute VI. (1182–1202) to establish the dominion of Denmark over the Baltic, mainly at the expense of the Wends. The policy of Absalon was continued on a still vaster scale by Valdemar II. (1202–1241), at a time when the German kingdom was too weak and distracted to intervene to save its seaboard; but the treachery of a vassal and the loss of one great battle sufficed to plunge this unwieldy, unsubstantial empire in the dust. (See VALDEMAR I., II., and ABSALON.)

Consolidation of the kingdom under the Valdemars, 1157–1281.

Yet the age of the Valdemars was one of the most glorious in Danish history, and it is of political importance as marking a turning-point. Favourable circumstances had, from the first, given the Danes the lead in Scandinavia. They held the richest and therefore the most populous lands, and geographically they were nearer than their neighbours to western civilization. Under the Valdemars, however, the ancient patriarchal system was merging into a more complicated development, of separate estates. The monarchy, now dominant, and far wealthier than before, rested upon the support of the great nobles, many of whom held their lands by feudal tenure, and constituted the royal *Raad*, or council. The clergy, fortified by royal privileges,

had also risen to influence; but celibacy and independence of the civil courts tended to make them more and more of a separate caste. Education was spreading. Numerous Danes, lay as well as clerical, regularly frequented the university of Paris. There were signs too of the rise of a vigorous middle class, due to the extraordinary development of the national resources (chiefly the herring fisheries, horse-breeding and cattle-rearing) and the foundation of gilds, the oldest of which, the *Edslag* of Schleswig, dates from the early 12th century. The *bonder*, or yeomen, were prosperous and independent, with well-defined rights. Danish territory extended over 60,000 sq. kilometres, or nearly double its present area; the population was about 700,000; and 160,000 men and 1400 ships were available for national defence.

On the death of Valdemar II. a period of disintegration ensued. Valdemar's son, Eric Plovpenning, succeeded him as king; but his near kinsfolk also received huge appanages, and family discords led to civil wars. Throughout the 13th and part of the 14th century, the struggle raged between the Danish kings and the Schleswig dukes; and of six monarchs no fewer than three died violent deaths. Superadded to these troubles was a prolonged struggle for supremacy between the popes and the crown, and, still more serious, the beginning of a breach between the kings and nobles, which had important constitutional consequences. The prevalent disorder had led to general lawlessness, in consequence of which the royal authority had been widely extended; and a strong opposition gradually arose which protested against the abuses of this authority. In 1282 the nobles extorted from King Eric Glipping, the first *Haandfaestning*, or charter, which recognized the *Danehof*, or national assembly, as a regular branch of the administration and gave guarantees against further usurpations. Christopher II. (1319–1332) was constrained to grant another charter considerably reducing the prerogative, increasing the privileges of the upper classes, and at the same time reducing the burden of taxation. But aristocratic licence proved as mischievous as royal incompetence; and on the death of Christopher II. the whole kingdom was on the verge of dissolution. Eastern Denmark was in the hands of one magnate; another magnate held Jutland and Fünen in pawn; the dukes of Schleswig were practically independent of the Danish crown; the Scanian provinces had (1332) surrendered themselves to Sweden.

Period of disintegration.

It was reserved for another Valdemar (Valdemar IV., *q.v.*) to reunite and weld together the scattered members of his heritage. His long reign (1340–1375) resulted in the re-establishment of Denmark as the great Baltic power. It is also a very interesting period of her social and constitutional development. This great ruler, who had to fight, year after year, against foreign and domestic foes, could, nevertheless, always find time to promote the internal prosperity of his much afflicted country. For the dissolution of Denmark, during the long anarchy, had been internal as well as external. The whole social fabric had been convulsed and transformed. The monarchy had been undermined. The privileged orders had aggrandized themselves at the expense of the community. The yeoman class had sunk into semi-serfdom. In a word, the natural cohesion of the Danish nation had been loosened and there was no security for law and justice. To make an end of this universal lawlessness Valdemar IV. was obliged, in the first place, to re-establish the royal authority by providing the crown with a regular and certain income. This he did by recovering the alienated royal demesnes in every direction, and from henceforth the annual *landgilde*, or rent, paid by the royal tenants, became the monarch's principal source of revenue. Throughout his reign Valdemar laboured incessantly to acquire as much land as possible. Moreover, the old distinction between the king's private estate and crown property henceforth ceases; all such property was henceforth regarded as the hereditary possession of the Danish crown.

Valdemar IV., 1340–1375.

The national army was also re-established on its ancient footing. Not only were the magnates sharply reminded that they held their lands on military tenure, but the towns were also made to contribute both men and ships, and peasant levies, especially archers, were recruited from every parish. Everywhere indeed Valdemar intervened personally. The smallest detail was not beneath his notice. Thus he invented nets for catching wolves and built innumerable water-mills, "for he would not let the waters run into the sea before they had been of use to the community." Under such a ruler law and order were speedily re-established. The popular tribunals regained their authority, and a supreme court of justice, *Det Kongelige Retterting*, presided over by Valdemar himself, not only punished the unruly and guarded the prerogatives of the crown, but also protected the weak and defenceless from the tyranny of the strong. Nor did Valdemar hesitate to meet his people in public and periodically render an account of his stewardship. He voluntarily resorted to the old practice of summoning national assemblies, the so-called *Danehof*. At the first of these assemblies held at Nyborg, Midsummer Day 1314, the bishops and councillors solemnly promised that the commonalty should enjoy all the ancient rights and privileges conceded to them by Valdemar II., and the wise provision that the *Danehof* should meet annually considerably strengthened its authority. The keystone to the whole constitutional system was "King Valdemar's Charter" issued in May 1360 at the *Rigsmöde*, or parliament, held at Kalundborg in May 1360. This charter was practically an act of national pacification, the provisions of which king and people together undertook to enforce for the benefit of the commonweal.

The work of Valdemar was completed and consolidated by his illustrious daughter Margaret (1375–1412), whose crowning achievement was the Union of Kalmar (1397), whereby she sought to combine the three northern kingdoms into a single state dominated by Denmark. In any case Denmark was bound to be the only gainer by the Union. Her population was double that of the two other kingdoms combined, and neither Margaret nor her successors observed the stipulations that each country should retain its own laws and customs and be ruled by natives only. In both Norway and Sweden, therefore, the Union was highly unpopular. The Norwegian aristocracy was too weak, however, seriously to endanger the Union at any time, but Sweden was, from the first, decidedly hostile to Margaret's whole policy. Nevertheless during her lifetime the system worked fairly well; but her pupil and successor, Eric of Pomerania, was unequal to the burden of empire and embroiled himself both with his neighbours and his subjects. The Hanseatic League, whose political ascendancy had been shaken by the Union, enraged by Eric's efforts to bring in the Dutch as commercial rivals, as well as by the establishment of the Sound tolls, materially assisted the Holsteiners in their twenty-five years' war with Denmark (1410–35), and Eric VII. himself was finally deposed (1439) in favour of his nephew, Christopher of Bavaria.

The Union of Kalmar, 1397.

The deposition of Eric marks another turning-point in Danish history. It was the act not of the people but of the *Rigsraad* (Senate), which had inherited the authority of the ancient *Danehof* and, after the death of Margaret, grew steadily in power at the expense of the crown. As the government grew more and more aristocratic, the position of the peasantry steadily deteriorated. It is under Christopher that we first hear, for instance, of the *Vornedskab*, or patriarchal control of the landlords over their tenants, a system which degenerated into rank slavery. In Jutland, too, after the repression, in 1441, of a peasant rising, something very like serfdom was introduced.

Growth of the power of the nobles.

On the death of Christopher III. without heirs, in 1448, the *Rigsraad* elected his distant cousin, Count Christian of Oldenburg, king; but Sweden preferred Karl Knutsson (Charles "VIII."), while Norway finally combined with Denmark, at the conference of Halmstad, in a double election which practically terminated the Union, though an agreement was come to that the survivor of the two kings should reign over all three kingdoms. Norway, subsequently, threw in her lot definitively with Denmark. Dissensions resulting in interminable civil wars had, even before the Union, exhausted the resources of the poorest of the three northern realms; and her ruin was completed by the ravages of the Black

Break-up of the Union.

Death, which wiped out two-thirds of her population. Unfortunately, too, for Norway's independence, the native gentry had gradually died out, and were succeeded by immigrant Danish fortune-hunters; native burgesses there were none, and the peasantry were mostly thralls; so that, excepting the clergy, there was no patriotic class to stand up for the national liberties.

Far otherwise was it in the wealthier kingdom of Sweden. Here the clergy and part of the nobility were favourable to the Union; but the vast majority of the people hated it as a foreign usurpation. Matters were still further complicated by the continual interference of the Hanseatic League; and Christian I. (1448–1481) and Hans (1481–1513), whose chief merit it is to have founded the Danish fleet, were, during the greater part of their reigns, only nominally kings of Sweden. Hans also received in fief the territory of Dietmarsch from the emperor, but, in attempting to subdue the hardy Dietmarschers, suffered a crushing defeat in which the national banner called "Danebrog" fell into the enemy's hands (1500). Moreover, this defeat led to a successful rebellion in Sweden, and a long and ruinous war with Lübeck, terminated by the peace of Malmö, 1512. It was during this war that a strong Danish fleet dominated the Baltic for the first time since the age of the Valdemars.

On the succession of Hans's son, Christian II. (1513–1523), Margaret's splendid dream of a Scandinavian empire seemed, finally, about to be realized. The young king, a man of character and genius, had wide views and original ideas. Elected king of Denmark and Norway, he succeeded in subduing Sweden by force of arms; but he spoiled everything at the culmination of his triumph by the hideous crime and blunder known as the Stockholm massacre, which converted the politically divergent Swedish nation into the irreconcilable foe of the unional government (see CHRISTIAN II.). Christian's contempt of nationality in Sweden is the more remarkable as in Denmark proper he sided with the people against the aristocracy, to his own undoing in that age of privilege and prejudice. His intentions, as exhibited to his famous *Landelove* (National Code), were progressive and enlightened to an eminent degree; so much so, indeed, that they mystified the people as much as they alienated the patricians; but his actions were often of revolting brutality, and his whole career was vitiated by an incurable double-mindedness which provoked general distrust. Yet there is no doubt that Christian II. was a true patriot, whose ideal it was to weld the three northern kingdoms into a powerful state, independent of all foreign influences, especially of German influence as manifested in the commercial tyranny of the Hansa League. His utter failure was due, partly to the vices of an undisciplined temperament, and partly to the extraordinary difficulties of the most inscrutable period of European history, when the shrewdest heads were at fault and irreparable blunders belonged to the order of the day. That period was the period of the Reformation, which profoundly affected the politics of Scandinavia. Christian II. had always subordinated religion to politics, and was Papist or Lutheran according to circumstances. But, though he treated the Church more like a foe than a friend and was constantly at war with the Curia, he retained the Catholic form of church worship and never seems to have questioned the papal supremacy. On the flight of Christian II. and the election of his uncle, Frederick I. (1523–1533), the Church resumed her jurisdiction and everything was placed on the old footing. The newly elected and still insecure German king at first remained neutral; but in the autumn of 1525 the current of Lutheranism began to run so strongly in Denmark as to threaten to whirl away every opposing obstacle. This novel and disturbing phenomenon was mainly due to the zeal and eloquence of the ex-monk Hans Tausen and his associates, or disciples, Peder Plad and Sadolin; and, in the autumn of 1526, Tausen was appointed one of the royal chaplains. The three ensuing years were especially favourable for the Reformation, as during that time the king had unlooked-for opportunities for filling the vacant episcopal sees with men after his own heart, and at heart he was a Lutheran. The reformation movement in Denmark was further promoted by Schleswig-Holstein influence. Frederick's eldest son Duke Christian had, since 1527, resided at Haderslev, where he collected round him Lutheran teachers from Germany, and made his court the centre of the propaganda of the new doctrine. On the other hand, the Odense Recess of the 20th of August 1527, which put both confessions on a footing of equality, remained unrepealed; and so long as it remained in force, the spiritual jurisdiction of the bishops, and, consequently, their authority over the "free preachers" (whose ambition convulsed all the important towns of Denmark and aimed at forcibly expelling the Catholic priests from their churches) remained valid, to the great vexation of the reformers. The inevitable ecclesiastical crisis was still further postponed by the superior stress of two urgent political events—Christian II.'s invasion of Norway (1531) and the outbreak, in 1533, of "*Grevens fejde*," or "The Count's War" (1534–36), the count in question being Christopher of Oldenburg, great-nephew of King Christian I., whom Lübeck and her allies, on the death of Frederick I., raised up against Frederick's son Christian III. The Catholic party and the lower orders generally took the part of Count Christopher, who acted throughout as the nominee of the captive Christian II., while the Protestant party, aided by the Holstein dukes and Gustavus Vasa of Sweden, sided with Christian III. The war ended with the capture of Copenhagen by the forces of Christian III., on the 29th of July 1536, and the triumph of so devoted a Lutheran sealed the fate of the Roman Catholic Church in Denmark, though even now it was necessary for the victorious king to proceed against the bishops and their friends by a *coup d'état*, engineered by his German generals the Rantzaus. The Recess of 1536 enacted that the bishops should forfeit their temporal and spiritual authority, and that all their property should be transferred to the crown for the good of the commonwealth. In the following year a Church ordinance, based upon the canons of Luther, Melanchthon and Bugenhagen, was drawn up, submitted to Luther for his approval, and promulgated on the 2nd of September 1537. On the same day seven "superintendents," including Tausen and Sadolin, all of whom had worked zealously for the cause of the Reformation, were consecrated in place of the dethroned bishops. The position of the superintendents and of the reformed church generally was consolidated by the Articles of Ribe in 1542, and the constitution of the Danish church has practically continued the same to the present day. But Catholicism could not wholly or immediately be dislodged by the teaching of Luther. It had struck deep roots into the habits and feelings of the people, and traces of its survival were distinguishable a whole century after the triumph of the Reformation. Catholicism lingered longest in the cathedral chapters. Here were to be found men of ability proof against the eloquence of Hans Tausen or Peder Plad and quite capable of controverting their theories—men like Povl Helgesen, for instance, indisputably the greatest Danish theologian of his day, a scholar whose voice was drowned amidst the clash of conflicting creeds.

Christian II., 1513–1523.

Frederick I., 1523–1533. The Reformation.

The Count's War, 1534–36.

Though the Reformation at first did comparatively little for education,[1] and the whole spiritual life of Denmark was poor and feeble in consequence for at least a generation afterwards, the change of religion was of undeniable, if temporary, benefit to the state from the political point of view. The enormous increase of the royal revenue consequent upon the confiscation of the property of the Church could not fail to increase the financial stability of the monarchy. In particular the suppression of the monasteries benefited the crown in two ways. The old church had, indeed, frequently rendered the state considerable financial aid, but such voluntary assistance was, from the nature of the case, casual and arbitrary. Now, however, the state derived a fixed and certain revenue from the confiscated lands; and the possession

Effects of the Reformation.

[1] It is true the university was established on the 9th of September 1537, but its influence was of very gradual growth and small at first.

of immense landed property at the same time enabled the crown advantageously to conduct the administration. The gross revenue of the state is estimated to have risen threefold. Before the Reformation the annual revenue from land averaged 400,000 bushels of corn; after the confiscations of Church property it averaged 1,200,000 bushels. The possession of a full purse materially assisted the Danish government in its domestic administration, which was indeed epoch-making. It enabled Christian III. to pay off his German mercenaries immediately after the religious *coup d'état* of 1536. It enabled him to prosecute shipbuilding with such energy that, by 1550, the royal fleet numbered at least thirty vessels, which were largely employed as a maritime police in the pirate-haunted Baltic and North Seas. It enabled him to create and remunerate adequately a capable official class, which proved its efficiency under the strictest supervision, and ultimately produced a whole series of great statesmen and admirals like Johan Friis, Peder Oxe, Herluf Trolle and Peder Skram. It is not too much to say that the increased revenue derived from the appropriation of Church property, intelligently applied, gave Denmark the hegemony of the North during the latter part of Christian III.'s reign, the whole reign of Frederick II. and the first twenty-five years of the reign of Christian IV., a period embracing, roughly speaking, eighty years (1544-1626). Within this period Denmark was indisputably the leading Scandinavian power. While Sweden, even after the advent of Gustavus Vasa, was still of but small account in Europe, Denmark easily held her own in Germany and elsewhere, even against Charles V., and was important enough, in 1553, to mediate a peace between the emperor and Saxony. Twice during this period Denmark and Sweden measured their strength in the open field, on the first occasion in the "Scandinavian Seven Years' War" (1562-70), on the second in the "Kalmar War" (1611-13), and on both occasions Denmark prevailed, though the temporary advantage she gained was more than neutralized by the intense feeling of hostility which the unnatural wars, between the two kindred peoples of Scandinavia, left behind them. Still, the fact remains that, for a time, Denmark was one of the great powers of Europe. Frederick II., in his later years (1571-1588), aspired to the dominion of all the seas which washed the Scandinavian coasts, and before he died he was able to enforce the rule that all foreign ships should strike their topsails to Danish men-of-war as a token of his right to rule the northern seas. Favourable political circumstances also contributed to this general acknowledgment of Denmark's maritime greatness. The power of the Hansa had gone; the Dutch were enfeebled by their contest with Spain; England's sea-power was yet in the making; Spain, still the greatest of the maritime nations, was exhausting her resources in the vain effort to conquer the Dutch. Yet more even than to felicitous circumstances, Denmark owed her short-lived greatness to the great statesmen and administrators whom Frederick II. succeeded in gathering about him. Never before, since the age of Margaret, had Denmark been so well governed, never before had she possessed so many political celebrities nobly emulous for the common good.

European influence of Denmark, 1544-1626.

Frederick II. was succeeded by his son Christian IV. (April 4, 1588), who attained his majority on the 17th of August 1596, at the age of nineteen. The realm which Christian IV. was to govern had undergone great changes within the last two generations. Towards the south the boundaries of the Danish state remained unchanged. Levensaa and the Eider still separated Denmark from the Empire. Schleswig was recognized as a Danish fief, in contradistinction to Holstein, which owed vassalage to the Empire. The "kingdom" stretched as far as Kolding and Skedborg, where the "duchy" began; and this duchy since its amalgamation with Holstein by means of a common *Landtag*, and especially since the union of the dual duchy with the kingdom on almost equal terms in 1533, was, in most respects, a semi-independent state. Denmark, moreover, like Europe in general, was, politically, on the threshold of a transitional period. During the whole course of the 16th century the monarchical form of government was in every large country, with the single exception of Poland, rising on the ruins of feudalism. The great powers of the late 16th and early 17th centuries were to be the strong, highly centralized, hereditary monarchies, like France, Spain and Sweden. There seemed to be no reason why Denmark also should not become a powerful state under the guidance of a powerful monarchy, especially as the sister state of Sweden was developing into a great power under apparently identical conditions. Yet, while Sweden was surely ripening into the dominating power of northern Europe, Denmark had as surely entered upon a period of uninterrupted and apparently incurable decline. What was the cause of this anomaly? Something of course must be allowed for the superior and altogether extraordinary genius of the great princes of the house of Vasa; yet the causes of the decline of Denmark lay far deeper than this. They may roughly be summed up under two heads: the inherent weakness of an elective monarchy, and the absence of that public spirit which is based on the intimate alliance of ruler and ruled. Whilst Gustavus Vasa had leaned upon the Swedish peasantry, in other words upon the bulk of the Swedish nation, which was and continued to be an integral part of the Swedish body-politic, Christian III. on his accession had crushed the middle and lower classes in Denmark and reduced them to political insignificance. Yet it was not the king who benefited by this blunder. The Danish monarchy since the days of Margaret had continued to be purely elective; and a purely elective monarchy at that stage of the political development of Europe was a mischievous anomaly. It signified in the first place that the crown was not the highest power in the state, but was subject to the aristocratic *Rigsraad*, or council of state. The *Rigsraad* was the permanent owner of the realm and the crown-lands; the king was only their temporary administrator. If the king died before the election of his successor, the *Rigsraad* stepped into the king's place. Moreover, an elective monarchy implied that, at every fresh succession, the king was liable to be bound by a new *Haandfaestning*, or charter. The election itself might, and did, become a mere formality; but the condition precedent of election, the acceptance of the charter, invariably limiting the royal authority, remained a reality. This period of aristocratic rule, which dates practically from the accession of Frederick I. (1523), and lasted for nearly a century and a half, is known in Danish history as *Adelsvaelde*, or rule of the nobles.

Denmark at the accession of Christian IV., 1588.

Again, the king was the ruler of the realm, but over a very large portion of it he had but a slight control. The crown-lands and most of the towns were under his immediate jurisdiction, but by the side of the crown-lands lay the estates of the nobility, which already comprised about one-half of the superficial area of Denmark, and were in many respects independent of the central government both as regards taxation and administration. In a word, the monarchy had to share its dominion with the nobility; and the Danish nobility in the 16th century was one of the most exclusive and selfish aristocracies in Europe, and already far advanced in decadence. Hermetically sealing itself from any intrusion from below, it deteriorated by close and constant intermarriage; and it was already, both morally and intellectually, below the level of the rest of the nation. Yet this very aristocracy, whose claim to consideration was based not upon its own achievements but upon the length of its pedigrees, insisted upon an amplification of its privileges which endangered the economical and political interests of the state and the nation. The time was close at hand when a Danish magnate was to demonstrate that he preferred the utter ruin of his country to any abatement of his own personal dignity.

All below the king and the nobility were generally classified together as "subjects." Of these lower orders the clergy stood first in the social scale. As a spiritual estate, indeed, it had ceased to exist at the Reformation, though still represented in the *Rigsdag* or diet. Since then too it had become quite detached from the nobility, which ostentatiously despised the teaching profession. The clergy recruited themselves therefore from the class next below them, and looked more and more to the

crown for help and protection as they drew apart from the gentry, who, moreover, as dispensers of patronage, lost no opportunity of appropriating church lands and cutting down tithes.

The burgesses had not yet recovered from the disaster of "Grevens fejde"; but while the towns had become more dependent on the central power, they had at the same time been released from their former vexatious subjection to the local magnates, and could make their voices heard in the *Rigsdag*, where they were still, though inadequately, represented. Within the Estate of Burgesses itself, too, a levelling process had begun. The old municipal patriciate, which used to form the connecting link between the *bourgeoisie* and the nobility, had disappeared, and a feeling of common civic fellowship had taken its place. All this tended to enlarge the political views of the burgesses, and was not without its influence on the future. Yet, after all, the prospects of the burgesses depended mainly on economic conditions; and in this respect there was a decided improvement, due to the increasing importance of money and commerce all over Europe, especially as the steady decline of the Hanse towns immediately benefited the trade of Denmark-Norway; Norway by this time being completely merged in the Danish state, and ruled from Copenhagen. There can, indeed, be no doubt that the Danish and Norwegian merchants at the end of the 16th century flourished exceedingly, despite the intrusion and competition of the Dutch and the dangers to neutral shipping arising from the frequent wars between England, Spain and the Netherlands.

At the bottom of the social ladder lay the peasants, whose condition had decidedly deteriorated. Only in one respect had they benefited by the peculiar conditions of the 16th century: the rise in the price of corn without any corresponding rise in the land-tax must have largely increased their material prosperity. Yet the number of peasant-proprietors had diminished, while the obligations of the peasantry generally had increased; and, still worse, their obligations were vexatiously indefinite, varying from year to year and even from month to month. They weighed especially heavily on the so-called *Ugedasmaend*, who were forced to work two or three days a week in the demesne lands. This increase of villenage morally depressed the peasantry, and widened still further the breach between the yeomanry and the gentry. Politically its consequences were disastrous. While in Sweden the free and energetic peasant was a salutary power in the state, which he served with both mind and plough, the Danish peasant was sinking to the level of a bondman. While the Swedish peasants were well represented in the Swedish *Riksdag*, whose proceedings they sometimes dominated, the Danish peasantry had no political rights or privileges whatever.

Such then, briefly, was the condition of things in Denmark when, in 1588, Christian IV. ascended the throne. Where so much was necessarily uncertain and fluctuating, there was room for an almost infinite variety of development. Much depended on the character and personality of the young prince who had now taken into his hands the reins of government, and for half a century was to guide the destinies of the nation. In the beginning of his reign the hand of the young monarch, who was nothing if not energetic, made itself felt in every direction. The harbours of Copenhagen, Elsinore and other towns were enlarged; many decaying towns were abolished and many new ones built under more promising conditions, including Christiania, which was founded in August 1624, on the ruins of the ancient city of Oslo. Various attempts were also made to improve trade and industry by abolishing the still remaining privileges of the Hanseatic towns, by promoting a wholesale immigration of skilful and well-to-do Dutch traders and handicraftsmen into Denmark under most favourable conditions, by opening up the rich fisheries of the Arctic seas, and by establishing joint-stock chartered companies both in the East and the West Indies. Copenhagen especially benefited by Christian IV.'s commercial policy. He enlarged and embellished it, and provided it with new harbours and fortifications; in short, did his best to make it the worthy capital of a great empire. But it was in the foreign policy of the government that the royal influence was most perceptible. Unlike Sweden, Denmark had remained outside the great religious-political movements which were the outcome of the Catholic reaction; and the peculiarity of her position made her rather hostile than friendly to the other Protestant states. The possession of the Sound enabled her to close the Baltic against the Western powers; the possession of Norway carried along with it the control of the rich fisheries which were Danish monopolies, and therefore a source of irritation to England and Holland. Denmark, moreover, was above all things a Scandinavian power. While the territorial expansion of Sweden in the near future was a matter of necessity, Denmark had not only attained, but even exceeded, her natural limits. Aggrandizement southwards, at the expense of the German empire, was becoming every year more difficult; and in every other direction she had nothing more to gain. Nay, more, Denmark's possession of the Scanian provinces deprived Sweden of her proper geographical frontiers. Clearly it was Denmark's wisest policy to seek a close alliance with Sweden in their common interests, and after the conclusion of the "Kalmar War" the two countries did remain at peace for the next thirty-one years. But the antagonistic interests of the two countries in Germany during the Thirty Years' War precipitated a fourth contest between them (1643–45), in which Denmark would have been utterly ruined but for the heroism of King Christian IV. and his command of the sea during the crisis of the struggle. Even so, by the peace of Brömsebro (February 8, 1645) Denmark surrendered the islands of Oesel and Gotland and the provinces of Jemteland and Herjedal (in Norway) definitively, and Halland for thirty years. The freedom from the Sound tolls was by the same treaty also extended to Sweden's Baltic provinces.

Christian IV., 1588–1648.

First losses of territory.

The peace of Brömsebro was the first of the long series of treaties, extending down to our own days, which mark the progressive shrinkage of Danish territory into an irreducible minimum. Sweden's appropriation of Danish soil had begun, and at the same time Denmark's power of resisting the encroachments of Sweden was correspondingly reduced. The Danish national debt, too, had risen enormously, while the sources of future income and consequent recuperation had diminished or disappeared. The Sound tolls, for instance, in consequence of the treaties of Brömsebro and Kristianopel (by the latter treaty very considerable concessions were made to the Dutch) had sunk from 400,000 to 140,000 rix-dollars. The political influence of the crown, moreover, had inevitably been weakened, and the conduct of foreign affairs passed from the hands of the king into the hands of the *Rigsraad*. On the accession of Frederick III. (1648–1670) moreover, the already diminished royal prerogative was still further curtailed by the *Haandfaestning*, or charter, which he was compelled to sign. Fear and hatred of Sweden, and the never abandoned hope of recovering the lost provinces, animated king and people alike; but it was Denmark's crowning misfortune that she possessed at this difficult crisis no statesman of the first rank, no one even approximately comparable with such competitors as Charles X. of Sweden or the "Great Elector" Frederick William of Brandenburg. From the very beginning of his reign Frederick III. was resolved upon a rupture at the first convenient opportunity, while the nation was, if possible, even more bellicose than the king. The apparently insuperable difficulties of Sweden in Poland was the feather that turned the scale; on the 1st of June 1657, Frederick III. signed the manifesto justifying a war which was never formally declared and brought Denmark to the very verge of ruin. The extraordinary details of this dramatic struggle will be found elsewhere (see FREDERICK III., king of Denmark, and CHARLES X., king of Sweden); suffice it to say that by the peace of Roskilde (February 26, 1658), Denmark consented to cede the three Scanian provinces, the island of Bornholm and the Norwegian provinces of Baahus and Trondhjem; to renounce all anti-Swedish alliances and to exempt all Swedish

Frederick III., 1648–1670.

Peace of Roskilde, 1658.

vessels, even when carrying foreign goods, from all tolls. These terrible losses were somewhat retrieved by the subsequent treaty of Copenhagen (May 27, 1660) concluded by the Swedish regency with Frederick III. after the failure of Charles X.'s second war against Denmark, a failure chiefly owing to the heroic defence of the Danish capital (1658–60). By this treaty Sweden gave back the province of Trondhjem and the isle of Bornholm and released Denmark from the most onerous of the obligations of the treaty of Roskilde. In fact the peace of Copenhagen came as a welcome break in an interminable series of disasters and humiliations. Anyhow, it confirmed the independence of the Danish state. On the other hand, if Denmark had emerged from the war with her honour and dignity unimpaired, she had at the same time tacitly surrendered the dominion of the North to her Scandinavian rival.

Treaty of Copenhagen, 1660.

But the war just terminated had important political consequences, which were to culminate in one of the most curious and interesting revolutions of modern history. In the first place, it marks the termination of the *Adelsvaelde*, or rule of the nobility. By their cowardice, incapacity, egotism and treachery during the crisis of the struggle, the Danish aristocracy had justly forfeited the respect of every other class of the community, and emerged from the war hopelessly discredited. On the other hand, Copenhagen, proudly conscious of her intrinsic importance and of her inestimable services to the country, whom she had saved from annihilation by her constancy, now openly claimed to have a voice in public affairs. Still higher had risen the influence of the crown. The courage and resource displayed by Frederick III. in the extremity of the national danger had won for "the least expansive of monarchs" an extraordinary popularity.

Hereditary monarchy established, 1660.

On the 10th of September 1660, the *Rigsdag*, which was to repair the ravages of the war and provide for the future, was opened with great ceremony in the *Riddersaal* of the castle of Copenhagen. The first bill laid before the Estates by the government was to impose an excise tax on the principal articles of consumption, together with subsidiary taxes on cattle, poultry, &c., in return for which the abolition of all the old direct taxes was promised. The nobility at first claimed exemption from taxation altogether, while the clergy and burgesses insisted upon an absolute equality of taxation. There were sharp encounters between the presidents of the contending orders, but the position of the Lower Estates was considerably prejudiced by the dissensions of its various sections. Thus the privileges of the bishops and of Copenhagen profoundly irritated the lower clergy and the unprivileged towns, and made a cordial understanding impossible, till Hans Svane, bishop of Copenhagen, and Hans Nansen the burgomaster, who now openly came forward as the leader of the reform movement, proposed that the privileges which divided the non-noble Estates should be abolished. In accordance with this proposal, the two Lower Estates, on the 16th of September, subscribed a memorandum addressed to the *Rigsraad*, declaring their willingness to renounce their privileges, provided the nobility did the same; which was tantamount to a declaration that the whole of the clergy and burgesses had made common cause against the nobility. The opposition so formed took the name of the "Conjoined Estates." The presentation of the memorial provoked an outburst of indignation. But the nobility soon perceived the necessity of complete surrender. On the 30th of September the First Estate abandoned its former standpoint and renounced its privileges, with one unimportant reservation.

The struggle now seemed to be ended, and the financial question having also been settled, the king, had he been so minded, might have dismissed the Estates. But the still more important question of reform was now raised. On the 17th of September the burgesses introduced a bill proposing a new constitution, which was to include local self-government in the towns, the abolition of serfdom, and the formation of a national army. It fell to the ground for want of adequate support; but another proposition, the fruit of secret discussion between the king and his confederates, which placed all fiefs under the control of the crown as regards taxation, and provided for selling and letting them to the highest bidder, was accepted by the Estate of burgesses. The significance of this ordinance lay in the fact that it shattered the privileged position of the nobility, by abolishing the exclusive right to the possession of fiefs. What happened next is not quite clear. Our sources fail us, and we are at the mercy of doubtful rumours and more or less unreliable anecdotes. We have a vision of intrigues, mysterious conferences, threats and bribery, dimly discernible through a shifting mirage of tradition.

The first glint of light is a letter, dated the 23rd of September, from Frederick III. to Svane and Nansen, authorizing them to communicate the arrangements already made to reliable men, and act quickly, as "if the others gain time they may possibly gain more." The first step was to make sure of the city train-bands: of the garrison of Copenhagen the king had no doubt. The headquarters of the conspirators was the bishop's palace near *Vor Frue* church, between which and the court messages were passing continually, and where the document to be adopted by the Conjoined Estates took its final shape. On the 8th of October the two burgomasters, Hans Nansen and Kristoffer Hansen, proposed that the realm of Denmark should be made over to the king as a hereditary kingdom, without prejudice to the privileges of the Estates; whereupon they proceeded to Brewer's Hall, and informed the Estate of burgesses there assembled of what had been done. A fiery oration from Nansen dissolved some feeble opposition; and simultaneously Bishop Svane carried the clergy along with him. The so-called "Instrument," now signed by the Lower Estates, offered the realm to the king and his house as a hereditary monarchy, by way of thank-offering mainly for his courageous deliverance of the kingdom during the war; and the *Rigsraad* and the nobility were urged to notify the resolution to the king, and desire him to maintain each Estate in its due privileges, and to give a written counter-assurance that the revolution now to be effected was for the sole benefit of the state. Events now moved forward rapidly. On the 10th of October a deputation from the clergy and burgesses proceeded to the Council House where the *Rigsraad* were deliberating, to demand an answer to their propositions. After a tumultuous scene, the aristocratic *Raad* rejected the "Instrument" altogether, whereupon the deputies of the commons proceeded to the palace and were graciously received by the king, who promised them an answer next day. The same afternoon the guards in the streets and on the ramparts were doubled; on the following morning the gates of the city were closed, powder and bullets were distributed among the city train-bands, who were bidden to be in readiness when the alarm bell called them, and cavalry was massed on the environs of the city. The same afternoon the king sent a message to the *Rigsraad* urging them to declare their views quickly, as he could no longer hold himself responsible for what might happen. After a feeble attempt at a compromise the *Raad* gave way. On the 13th of October it signed a declaration to the effect that it associated itself still with the Lower Estates in the making over of the kingdom, as a hereditary monarchy, to his majesty and his heirs male and female. The same day the king received the official communication of this declaration and the congratulation of the burgomasters. Thus the ancient constitution was transformed; and Denmark became a monarchy hereditary in Frederick III. and his posterity.

But although hereditary sovereignty had been introduced, the laws of the land had not been abolished. The monarch was specifically now a sovereign over-lord, but he had not been absolved from his obligations towards his subjects. Hereditary sovereignty *per se* was not held to signify unlimited dominion, still less absolutism. On the contrary, the magnificent gift of the Danish nation to Frederick III. was made under express conditions. The "Instrument" drawn up by the Lower Estates implied the retention of all their rights; and the king, in accepting the gift of a hereditary crown, did not repudiate the implied inviolability of the privileges of the donors.

Unfortunately everything had been left so vague, that it was an easy matter for ultra-royalists like Svane and Nansen to ignore the privileges of the Estates, and even the Estates themselves.

On the 14th of October a committee was summoned to the palace to organize the new government. The discussion turned mainly upon two points, (1) whether a new oath of homage should be taken to the king, and (2) what was to be done with the *Haandfaestning* or royal charter. The first point was speedily decided in the affirmative, and, as to the second, it was ultimately decided that the king should be released from his oath and the charter returned to him; but a rider was added suggesting that he should, at the same time, promulgate a Recess providing for his own and his people's welfare. Thus Frederick III. was not left absolutely his own master; for the provision regarding a Recess, or new constitution, showed plainly enough that such a constitution was expected, and, once granted, would of course have limited the royal power.

It now only remained to execute the resolutions of the committee. On the 17th of October the charter, which the king had sworn to observe twelve years before, was solemnly handed back to him at the palace, Frederick III. thereupon promising to rule as a Christian king to the satisfaction of all the Estates of the realm. On the following day the king, seated on the topmost step of a lofty tribune surmounted by a baldaquin, erected in the midst of the principal square of Copenhagen, received the public homage of his subjects of all ranks, in the presence of an immense concourse, on which occasion he again promised to rule "as a Christian hereditary king and gracious master," and, "as soon as possible, to prepare and set up" such a constitution as should secure to his subjects a Christian and indulgent sway. The ceremony concluded with a grand banquet at the palace. After dinner the queen and the clergy withdrew; but the king remained. An incident now occurred which made a strong impression on all present. With a brimming beaker in his hand, Frederick III. went up to Hans Nansen, drank with him and drew him aside. They communed together in a low voice for some time, till the burgomaster, succumbing to the influence of his potations, fumbled his way to his carriage with the assistance of some of his civic colleagues. Whether Nansen, intoxicated by wine and the royal favour, consented on this occasion to sacrifice the privileges of his order and his city, it is impossible to say; but it is significant that, from henceforth, we hear no more of the Recess which the more liberal of the leaders of the lower orders had hoped for when they released Frederick III. from the obligations of the charter.

We can follow pretty plainly the stages of the progress from a limited to an absolute monarchy. By an act dated the 10th of January 1661, entitled "Instrument, or pragmatic sanction," of the king's hereditary right to the kingdoms of Denmark and Norway, it was declared that all the prerogatives of majesty, and "all regalia as an absolute sovereign lord," had been made over to the king. Yet, even after the issue of the "Instrument," there was nothing, strictly speaking, to prevent Frederick III. from voluntarily conceding to his subjects some share in the administration. Unfortunately the king was bent upon still further emphasizing the plenitude of his power. At Copenhagen his advisers were busy framing drafts of a *Lex Regia Perpetua*; and the one which finally won the royal favour was the famous *Kongelov*, or "King's Law."

Establishment of absolute rule.

This document was in every way unique. In the first place it is remarkable for its literary excellence. Compared with the barbarous macaronic jargon of the contemporary official language it shines forth as a masterpiece of pure, pithy and original Danish. Still more remarkable are the tone and tenor of this royal law. The *Kongelov* has the highly dubious honour of being the one written law in the civilized world which fearlessly carries out absolutism to the last consequences. The monarchy is declared to owe its origin to the surrender of the supreme authority by the Estates to the king. The maintenance of the indivisibility of the realm and of the Christian faith according to the Augsburg Confession, and the observance of the *Kongelov* itself, are now the sole obligations binding upon the king. The supreme spiritual authority also is now claimed; and it is expressly stated that it becomes none to crown him; the moment he ascends the throne, crown and sceptre belong to him of right. Moreover, par. 26 declares guilty of *læse-majesté* whomsoever shall in any way usurp or infringe the king's absolute authority. In the following reign the ultra-royalists went further still. In their eyes the king was not merely autocratic, but sacrosanct. Thus before the anointing of Christian V. on the 7th of June 1671, a ceremony by way of symbolizing the new autocrat's humble submission to the Almighty, the officiating bishop of Zealand delivered an oration in which he declared that the king was God's immediate creation, His vicegerent on earth, and that it was the bounden duty of all good subjects to serve and honour the celestial majesty as represented by the king's terrestrial majesty. The *Kongelov* is dated and subscribed the 14th of November 1665, but was kept a profound secret, only two initiated persons knowing of its existence until after the death of Frederick III., one of them being Kristoffer Gabel, the king's chief intermediary during the revolution, and the other the author and custodian of the *Kongelov*, Secretary Peder Schumacher, better known as Griffenfeldt. It is significant that both these confidential agents were plebeians.

The revolution of 1660 was certainly beneficial to Norway. With the disappearance of the *Rigsraad*, which, as representing the Danish crown, had hitherto exercised sovereignty over both kingdoms, Norway ceased to be a subject principality. The sovereign hereditary king stood in exactly the same relations to both kingdoms; and thus, constitutionally, Norway was placed on an equality with Denmark, united with but not subordinate to it. It is clear that the majority of the Norwegian people hoped that the revolution would give them an administration independent of the Danish government; but these expectations were not realised. Till the cessation of the Union in 1814, Copenhagen continued to be the headquarters of the Norwegian administration; both kingdoms had common departments of state; and the common chancery continued to be called the Danish chancery. On the other hand the condition of Norway was now greatly improved. In January 1661 a land commission was appointed to investigate the financial and economical conditions of the kingdoms; the fiefs were transformed into counties; the nobles were deprived of their immunity from taxation; and in July 1662 the Norwegian towns received special privileges, including the monopoly of the lucrative timber trade.

Effects of the revolution of 1660.

The *Enevaelde*, or absolute monarchy, also distinctly benefited the whole Danish state by materially increasing its reserve of native talent. Its immediate consequence was to throw open every state appointment to the middle classes; and the middle classes of that period, with very few exceptions, monopolized the intellect and the energy of the nation. New blood of the best quality nourished and stimulated the whole body politic. Expansion and progress were the watchwords at home, and abroad it seemed as if Denmark were about to regain her former position as a great power. This was especially the case during the brief but brilliant administration of Chancellor Griffenfeldt. Then, if ever, Denmark had the chance of playing once more a leading part in international politics. But Griffenfeldt's difficulties, always serious, were increased by the instability of the European situation, depending as it did on the ambition of Louis XIV. Resolved to conquer the Netherlands, the French king proceeded, first of all, to isolate her by dissolving the Triple Alliance. (See SWEDEN and GRIFFENFELDT.) In April 1672 a treaty was concluded between France and Sweden, on condition that France should not include Denmark in her system of alliances without the consent of Sweden. This treaty showed that Sweden weighed more in the French balances than Denmark. In June 1672 a French army invaded the Netherlands; whereupon the elector of Brandenburg contracted an alliance with the emperor Leopold, to which Denmark was invited to accede; almost simultaneously

Christian V., 1670-1699.

the States-General began to negotiate for a renewal of the recently expired Dano-Dutch alliance.

In these circumstances it was as difficult for Denmark to remain neutral as it was dangerous for her to make a choice. An alliance with France would subordinate her to Sweden; an alliance with the Netherlands would expose her to an attack from Sweden. The Franco-Swedish alliance left Griffenfeldt no choice but to accede to the opposite league, for he saw at once that the ruin of the Netherlands would disturb the balance of power in the north by giving an undue preponderance to England and Sweden. But Denmark's experience of Dutch promises in the past was not reassuring; so, while negotiating at the Hague for a renewal of the Dutch alliance, he at the same time felt his way at Stockholm towards a commercial treaty with Sweden. His Swedish mission proved abortive, but, as he had anticipated, it effectually accelerated the negotiations at the Hague, and frightened the Dutch into unwonted liberality. In May 1673 a treaty of alliance was signed by the ambassador of the States-General at Copenhagen, whereby the Netherlands pledged themselves to pay Denmark large subsidies in return for the services of 10,000 men and twenty warships, which were to be held in readiness in case the United Provinces were attacked by another enemy besides France. Thus, very dexterously, Griffenfeldt had succeeded in gaining his subsidies without sacrificing his neutrality.

Denmark in the Great Northern War.

His next move was to attempt to detach Sweden from France; but, Sweden showing not the slightest inclination for a *rapprochement*, Denmark was compelled to accede to the anti-French league, which she did by the treaty of Copenhagen, of January 1674, thereby engaging to place an army of 20,000 in the field when required; but here again Griffenfeldt safeguarded himself to some extent by stipulating that this provision was not to be operative till the allies were attacked by a fresh enemy. When, in December 1674, a Swedish army invaded Prussian Pomerania, Denmark was bound to intervene as a belligerent, but Griffenfeldt endeavoured to postpone this intervention as long as possible; and Sweden's anxiety to avoid hostilities with her southern neighbour materially assisted him to postpone the evil day. He only wanted to gain time, and he gained it. To the last he endeavoured to avoid a rupture with France even if he broke with Sweden; but he could not restrain for ever the foolish impetuosity of his own sovereign, Christian V., and his fall in the beginning of 1676 not only, as he had foreseen, involved Denmark in an unprofitable war, but, as his friend and disciple, Jens Juel, well observed, relegated her henceforth to the humiliating position of an international catspaw. Thus at the peace of Fontainebleau (September 2, 1679) Denmark, which had borne the brunt of the struggle in the Baltic, was compelled by the inexorable French king to make full restitution to Sweden, the treaty between the two northern powers being signed at Lund on the 26th of September. Freely had she spent her blood and her treasure, only to emerge from the five years' contest exhausted and empty-handed.

By the peace of Fontainebleau Denmark had been sacrificed to the interests of France and Sweden; forty-one years later she was sacrificed to the interests of Hanover and Prussia by the peace of Copenhagen (1720), which ended the Northern War so far as the German powers were concerned. But it would not have terminated advantageously for them at all, had not the powerful and highly efficient Danish fleet effectually prevented the Swedish government from succouring its distressed German provinces, and finally swept the Swedish fleets out of the northern waters. Yet all the compensation Denmark received for her inestimable services during a whole decade was 600,000 rix-dollars! The bishopries of Bremen and Verden, the province of Farther Pomerania and the isle of Rügen which her armies had actually conquered, and which had been guaranteed to her by a whole catena of treaties, went partly to the upstart electorate of Hanover and partly to the upstart kingdom of Prussia, both of which states had been of no political importance whatever at the beginning of the war of spoliation by which they were, ultimately, to profit so largely and so cheaply.

The last ten years of the reign of Christian V.'s successor, Frederick IV. (1699–1730), were devoted to the nursing and development of the resources of the country, which had suffered only less severely than Sweden from the effects of the Great Northern War. The court, seriously pious, did much for education. A wise economy also contributed to reduce the national debt within manageable limits, and in the welfare of the peasantry Frederick IV. took a deep interest. In 1722 serfdom was abolished in the case of all peasants in the royal estates born after his accession.

Frederick IV., 1699–1730.

The first act of Frederick's successor, Christian VI. (1730–1746), was to abolish the national militia, which had been an intolerable burden upon the peasantry; yet the more pressing agrarian difficulties were not thereby surmounted, as had been hoped. The price of corn continued to fall; the migration of the peasantry assumed alarming proportions; and at last, "to preserve the land" as well as to increase the defensive capacity of the country, the national militia was re-established by the decree of the 4th of February 1733, which at the same time bound to the soil all peasants between the age of nine and forty. Reactionary as the measure was it enabled the agricultural interest, on which the prosperity of Denmark mainly depended, to tide over one of the most dangerous crises in its history; but certainly the position of the Danish peasantry was never worse than during the reign of the religious and benevolent Christian VI.

Christian VI., 1730–1746.

Under the peaceful reign of Christian's son and successor, Frederick V. (1746–1766), still more was done for commerce, industry and agriculture. To promote Denmark's carrying trade, treaties were made with the Barbary States, Genoa and Naples; and the East Indian Trading Company flourished exceedingly. On the other hand the condition of the peasantry was even worse under Frederick V. than it had been under Christian VI., the *Stavnsbaand*, or regulation which bound all males to the soil, being made operative from the age of four. Yet signs of a coming amelioration were not wanting. The theory of the physiocrats now found powerful advocates in Denmark; and after 1755, when the press censorship was abolished so far as regarded political economy and agriculture, a thorough discussion of the whole agrarian question became possible. A commission appointed in 1757 worked zealously for the repeal of many agricultural abuses; and several great landed proprietors introduced hereditary leaseholds, and abolished the servile tenure.

Frederick V., 1746–1766.

Foreign affairs during the reigns of Frederick V. and Christian VI. were left in the capable hands of J. H. E. Bernstorff, who aimed at steering clear of all foreign complications and preserving inviolable the neutrality of Denmark. This he succeeded in doing, in spite of the Seven Years' War and of the difficulties attending the thorny Gottorp question in which Sweden and Russia were equally interested. The same policy was victoriously pursued by his nephew and pupil Andreas Bernstorff, an even greater man than the elder Bernstorff, who controlled the foreign policy of Denmark from 1773 to 1778, and again from 1784 till his death in 1797. The period of the younger Bernstorff synchronizes with the greater part of the long reign of Christian VII. (1766–1808), one of the most eventful periods of modern Danish history. The king himself was indeed a semi-idiot, scarce responsible for his actions, yet his was the era of such striking personalities as the brilliant charlatan Struensee, the great philanthropist and reformer C. D. F. Reventlow, the ultra-conservative Ove Hoegh-Guldberg, whose mission it was to repair the damage done by Struensee, and that generation of alert and progressive spirits which surrounded the young crown prince Frederick, whose first act, on taking his seat in the council of state, at the age of sixteen, on the 4th of April 1784, was to dismiss Guldberg.

Christian VII., 1766–1808.

A fresh and fruitful period of reform now began, lasting till nearly the end of the century, and interrupted only by the brief but costly war with Sweden in 1788. The emancipation of the peasantry was now the burning question of the day, and the whole matter was thoroughly ventilated. Bernstorff and the

crown prince were the most zealous advocates of the peasantry in the council of state; but the honour of bringing the whole peasant question within the range of practical politics undoubtedly belongs to C. D. F. Reventlow (*q.v.*). Nor was the reforming principle limited to the abolition of serfdom. In 1788 the corn trade was declared free; the Jews received civil rights; and the negro slave trade was forbidden. In 1796 a special ordinance reformed the whole system of judicial procedure, making it cheaper and more expeditious; while the toll ordinance of the 1st of February 1797 still further extended the principle of free trade. Moreover, until two years after Bernstorff's death in 1797, the Danish press enjoyed a larger freedom of speech than the press of any other absolute monarchy in Europe, so much so that at last Denmark became suspected of favouring Jacobin views. But in September 1799 under strong pressure from the Russian emperor Paul, the Danish government forbade anonymity, and introduced a limited censorship.

It was Denmark's obsequiousness to Russia which led to the first of her unfortunate collisions with Great Britain. In 1800 the Danish government was persuaded by the tsar to accede to the second Armed Neutrality League, which Russia had just concluded with Prussia and Sweden. Great Britain retaliated by laying an embargo on the vessels of the three neutral powers, and by sending a considerable fleet to the Baltic under the command of Parker and Nelson. Surprised and unprepared though they were, the Danes, nevertheless, on the 2nd of April 1801, offered a gallant resistance; but their fleet was destroyed, their capital bombarded, and, abandoned by Russia, they were compelled to submit to a disadvantageous peace.

Denmark and Great Britain in the Napoleonic Wars.

The same vain endeavour of Denmark to preserve her neutrality led to the second breach with England. After the peace of Tilsit there could be no further question of neutrality. Napoleon had determined that if Great Britain refused to accept Russia's mediation, Denmark, Sweden and Portugal were to be forced to close their harbours to her ships and declare war against her. It was the intention of the Danish government to preserve its neutrality to the last, although, on the whole, it preferred an alliance with Great Britain to a league with Napoleon, and was even prepared for a breach with the French emperor if he pressed her too hardly. The army had therefore been assembled in Holstein, and the crown prince regent was with it. But the British government did not consider Denmark strong enough to resist France, and Canning had private trustworthy information of the designs of Napoleon, upon which he was bound to act. He sent accordingly a fleet, with 30,000 men on board, to the Sound to compel Denmark, by way of security for her future conduct, to unite her fleet with the British fleet. Denmark was offered an alliance, the complete restitution of her fleet after the war, a guarantee of all her possessions, compensation for all expenses, and even territorial aggrandizement.

Dictatorially presented as they were, these terms were liberal and even generous; and if a great statesman like Bernstorff had been at the head of affairs in Copenhagen, he would, no doubt, have accepted them, even if with a wry face. But the prince regent, if a good patriot, was a poor politician, and invincibly obstinate. When, therefore, in August 1807, Gambier arrived in the Sound, and the English plenipotentiary Francis James Jackson, not perhaps the most tactful person that could have been chosen, hastened to Kiel to place the British demands before the crown prince, Frederick not only refused to negotiate, but ordered the Copenhagen authorities to put the city in the best state of defence possible. Taking this to be tantamount to a declaration of war, on the 16th of August the British army landed at Vedbäck; and shortly afterwards the Danish capital was invested. Anything like an adequate defence was hopeless; a bombardment began which lasted rom the 2nd of September till the 5th of September, and ended with the capitulation of the city and the surrender of the fleet intact, the prince regent having neglected to give orders for its destruction. After this Denmark, unwisely, but not unnaturally, threw herself into the arms of Napoleon and continued to be his faithful ally till the end of the war. She was punished for her obstinacy by being deprived of Norway, which she was compelled to surrender to Sweden by the terms of the treaty of Kiel (1814), on the 14th of January, receiving by way of compensation a sum of money and Swedish Pomerania, with Rügen, which were subsequently transferred to Prussia in exchange for the duchy of Lauenburg and 2,000,000 rix-dollars.

Loss of Norway. Treaty of Kiel, 1814.

On the establishment of the German Confederation in 1815, Frederick VI. acceded thereto as duke of Holstein, but refused to allow Schleswig to enter it, on the ground that Schleswig was an integral part of the Danish realm.

The position of Denmark from 1815 to 1830 was one of great difficulty and distress. The loss of Norway necessitated considerable reductions of expenditure, but the economies actually practised fell far short of the requirements of the diminished kingdom and its depleted exchequer; while the agricultural depression induced by the enormous fall in the price of corn all over Europe caused fresh demands upon the state, and added 10,000,000 rix-dollars to the national debt before 1835. The last two years of the reign of Frederick VI. (1838–1839) were also remarkable for the revival of political life, provincial consultative assemblies being established for Jutland, the Islands, Schleswig and Holstein, by the ordinance of the 28th of May 1831. But these consultative assemblies were regarded as insufficient by the Danish Liberals, and during the last years of Frederick VI. and the whole reign of his successor, Christian VIII. (1839–1848), the agitation for a free constitution, both in Denmark and the duchies, continued to grow in strength, in spite of press prosecutions and other repressive measures. The rising national feeling in Germany also stimulated the separatist tendencies of the duchies; and "Schleswig-Holsteinism," as it now began to be called, evoked in Denmark the counter-movement known as *Eiderdansk-politik*, *i.e.* the policy of extending Denmark to the Eider and obliterating German Schleswig, in order to save Schleswig from being absorbed by Germany. This division of national sentiment within the monarchy, complicated by the approaching extinction of the Oldenburg line of the house of Denmark, by which, in the normal course under the Salic law, the succession to Holstein would have passed away from the Danish crown, opened up the whole complicated Schleswig-Holstein Question with all its momentous consequences. (See SCHLESWIG-HOLSTEIN QUESTION.) Within the monarchy itself, during the following years, "Schleswig-Holsteinism" and "Eiderdanism" faced each other as rival, mutually exacerbating forces; and the efforts of succeeding governments to solve the insoluble problem broke down ever on the rock of nationalist passion and the interests of the German powers. The unionist constitution, devised by Christian VIII., and promulgated by his successor, Frederick VII. (1848–1863), on the 28th of January 1848, led to the armed intervention of Prussia, at the instance of the new German parliament at Frankfort; and, though with the help of Russian and British diplomacy, the Danes were ultimately successful, they had to submit, in 1851, to the government of Holstein by an international commission consisting of three members, Prussian, Austrian and Danish respectively.

Denmark after 1815.

Constitutional agitation. Beginnings of the Schleswig-Holstein Question.

Unionist Constitution of 1848, and war with Prussia.

Denmark, meanwhile, had been engaged in providing herself with a parliament on modern lines. The constitutional rescript of the 28th of January 1848 had been withdrawn in favour of an electoral law for a national assembly, of whose 152 members 38 were to be nominated by the king and to form an Upper House (*Landsting*), while the remainder were to be elected by the people and to form a popular chamber (*Folketing*). The *Bondevenlige*, or philo-peasant party, which objected to the king's right of nomination and preferred a one-chamber system, now separated from the National Liberals on this point. But the National Liberals triumphed at the general election; fear of reactionary tendencies finally induced the Radicals to accede to the wishes of the majority; and on the 5th of June 1849 the new constitution received the royal sanction.

At this stage Denmark's foreign relations prejudicially affected her domestic politics. The Liberal Eiderdansk party was for dividing Schleswig into three distinct administrative belts, according as the various nationalities predominated (language rescripts of 1851), but German sentiment was opposed to any such settlement and, still worse, the great continental powers looked askance on the new Danish constitution as far too democratic. The substance of the notes embodying the exchange of views, in 1851 and 1852, between the German great powers and Denmark, was promulgated, on the 28th of January 1852, in the new constitutional decree which, together with the documents on which it was founded, was known as the Conventions of 1851 and 1852. Under this arrangement each part of the monarchy was to have local autonomy, with a common constitution for common affairs. Holstein was now restored to Denmark, and Prussia and Austria consented to take part in the conference of London, by which the integrity of Denmark was upheld, and the succession to the whole monarchy settled on Prince Christian, youngest son of Duke William of Schleswig-Holstein-Sonderburg-Glücksburg, and husband of Louise of Hesse, the niece of King Christian VIII. The "legitimate" heir to the duchies, under the Salic law, Duke Christian of Sonderburg-Augustenburg, accepted the decision of the London conference in consideration of the purchase by the Danish government of his estates in Schleswig.

Germany and the Danish duchies.

Convention of 1852.

On the 2nd of October 1855 was promulgated the new common constitution, which for two years had been the occasion of a fierce contention between the Conservatives and the Radicals. It proved no more final than its predecessors. The representatives of the duchies in the new common *Rigsraad* protested against it, as subversive of the Conventions of 1851 and 1852; and their attitude had the support of the German powers. In 1857, Carl Christian Hall (*q.v.*) became prime minister. After putting off the German powers by seven years of astute diplomacy, he realized the impossibility of carrying out the idea of a common constitution and, on the 30th of March 1862, a royal proclamation was issued detaching Holstein as far as possible from the common monarchy. Later in the year he introduced into the *Rigsraad* a common constitution for Denmark and Schleswig, which was carried through and confirmed by the council of state on the 13th of November 1863. It had not, however, received the royal assent when the death of Frederick VII. brought the "Protocol King" Christian IX. to the throne. Placed between the necessity of offending his new subjects or embroiling himself with the German powers, Christian chose the remoter evil and, on the 18th of November, the new constitution became law. This once more opened up the whole question in an acute form. Frederick, son of Christian of Augustenburg, refusing to be bound by his father's engagements, entered Holstein and, supported by the Estates and the German diet, proclaimed himself duke. The events that followed: the occupation of the duchies by Austria and Prussia, the war of 1864, gallantly fought by the Danes against overwhelming odds, and the astute diplomacy by which Bismarck succeeded in ultimately gaining for Prussia the seaboard so essential for her maritime power, are dealt with elsewhere (see SCHLESWIG-HOLSTEIN QUESTION). For Denmark the question was settled when, by the peace of Vienna (October 30, 1864), the duchies were irretrievably lost to her. At the peace of Prague, which terminated the Austro-Prussian War of 1866, Napoleon III. procured the insertion in the treaty of paragraph v., by which the northern districts of Schleswig were to be reunited to Denmark when the majority of the population by a free vote should so desire; but when Prussia at last thought fit to negotiate with Denmark on the subject, she laid down conditions which the Danish government could not accept. Finally, in 1878, by a separate agreement between Austria and Prussia, paragraph v. was rescinded.

Constitution of 1855.

Constitution of 1863 and accession of Christian IX.

Prusso-Danish War of 1864, and cession of the duchies.

The salient feature of Danish politics during subsequent years was the struggle between the two *Tings*, the *Folketing* or Low House, and the *Landsting*, or Upper House of the *Rigsdag*. This contest began in 1872, when a combination of all the Radical parties, known as the "United Left," passed a vote of want of confidence against the government and rejected the budget. Nevertheless, the ministry, supported by the *Landsting*, refused to resign; and the crisis became acute when, in 187 J. B. Estrup became prime minister. Perceiving that the comi struggle would be essentially a financial one, he retained t ministry of finance in his own hands; and, strong in the suppc of the king, the *Landsting*, and a considerable minority in t country itself, he devoted himself to the double task of establis ing the political parity of the *Landsting* with the *Folketing* a strengthening the national armaments, so that, in the event a war between the European great powers, Denmark might able to defend her neutrality.

Constitutional struggle in Denmark 1866.

The Left was willing to vote 30,000,000 crowns f extraordinary military expenses, exclusive of the fortificatio of Copenhagen, on condition that the amount should be rais by a property and income tax; and, as the elections of 1875 h given them a majority of three-fourths in the popular chamb they spoke with no uncertain voice. But the Upper Hou steadily supported Estrup, who was disinclined to accept a such compromise. As an agreement between the two houses the budget proved impossible, a provisional financial decree w issued on the 12th of April 1877, which the Left stigmatized as breach of the constitution. But the difficulties of the minist were somewhat relieved by a split in the Radical party, st further accentuated by the elections of 1879, which enabl Estrup to carry through the army and navy defence bill a the new military penal code by leaning alternately upon one the other of the divided Radical groups.

After the elections of 1881, which brought about the reamalg mation of the various Radical sections, the opposition present a united front to the government, so that, from 1882 onward legislation was almost at a standstill. The elections of 18 showed clearly that the nation was also now on the side of t Radicals, 83 out of the 102 members of the *Folketing* belongi to the opposition. Still Estrup remained at his post. He h underestimated the force of public opinion, but he was conscient ously convinced that a Conservative ministry was necessary Denmark at this crisis. When therefore the *Rigsdag* rejecte the budget, he advised the king to issue another provision financial decree. Henceforth, so long as the *Folketing* refused vote supplies, the ministry regularly adopted these makeshift In 1886 the Left, having no constitutional means of dismissir the Estrup ministry, resorted for the first time to negotiations but it was not till the 1st of April 1894 that the majority of t *Folketing* could arrive at an agreement with the government an the *Landsting* as to a budget which should be retrospective an sanction the employment of the funds so irregularly obtained f military expenditure. The whole question of the provision financial decrees was ultimately regularized by a special resolutio of the *Rigsdag*; and the retirement of the Estrup ministry i August 1894 was the immediate result of the compromise.

In spite of the composition of 1894, the animosity betwee *Folketing* and *Landsting* continues to characterize Danish politic and the situation has been complicated by the division of bot Right and Left into widely divergent groups. The elections 1895 resulted in an undeniable victory of the extreme Radicals and the budget of 1895–1896 was passed only at the last momer by a compromise. The session of 1896–1897 was remarkable f a *rapprochement* between the ministry and the "Left Refor Party," caused by the secessions of the "Young Right" which le to an unprecedented event in Danish politics—the voting of th budget by the Radical *Folketing* and its rejection by the Conserv tive *Landsting* in May 1897; whereupon the ministry resigne in favour of the moderate Conservative Hörring cabinet, whic induced the Upper House to pass the budget. The elections 1898 were a fresh defeat for the Conservatives, and in the autum session of the same year, the *Folketing*, by a crushing majority

85 to 12, rejected the military budget. The ministry was saved by a mere accident—the expulsion of Danish agitators from North Schleswig by the German government, which evoked a passion of patriotic protest throughout Denmark, and united all parties, the war minister declaring in the *Folketing*, during the debate on the military budget (January 1899), that the armaments of Denmark were so far advanced that any great power must think twice before venturing to attack her. The chief event of the year 1899 was the great strike of 40,000 artisans, which cost Denmark 50,000,000 crowns, and brought about a reconstruction of the cabinet in order to bring in, as minister of the interior, Ludwig Ernst Bramsen, the great specialist in industrial matters, who succeeded (September 2-4) in bringing about an understanding between workmen and employers. The session 1900–1901 was remarkable for the further disintegration of the Conservative party still in office (the Sehested cabinet superseded the Hörring cabinet on the 27th of April 1900) and the almost total paralysis of parliament, caused by the interminable debates on the question of taxation reform. The crisis came in 1901. Deprived of nearly all its supporters in the *Folketing*, the Conservative ministry resigned, and King Christian was obliged to assent to the formation of a "cabinet of the Left" under Professor Deuntzer. Various reforms were carried, but the proposal to sell the Danish islands in the West Indies to the United States fell through. During these years the relations between Denmark and the German empire improved, and in the country itself the cause of social democracy made great progress. In January 1906 King Christian ended his long reign, and was succeeded by his son Frederick VIII. At the elections of 1906 the government lost its small absolute majority, but remained in power with support from the Moderates and Conservatives. It was severely shaken, however, when Herr A. Alberti, who had been minister of justice since 1901, and was admitted to be the strongest member of the cabinet, was openly accused of nepotism and abuse of the power of his position. These charges gathered weight until the minister was forced to resign in July 1908, and in September he was arrested on a charge of forgery in his capacity as director of the Zealand Peasants' Savings Bank. The ministry, of which Herr Jens Christian Christensen was head, was compelled to resign in October. The effect of these revelations was profound not only politically, but also economically; the important export trade in Danish butter, especially, was adversely affected, as Herr Alberti had been interested in numerous dairy companies.

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LITERATURE

The present language of Denmark is derived directly from the same source as that of Sweden, and the parent of both is the old Scandinavian (see SCANDINAVIAN LANGUAGES). In Iceland this tongue, with some modifications, has remained in use, and until about 1100 it was the literary language of the whole of Scandinavia. The influence of Low German first, and High German afterwards, has had the effect of drawing modern Danish constantly farther from this early type. The difference began to show itself in the 12th century. R. K. Rask, and after him N. M. Petersen, have distinguished four periods in the development of the language. The first, which has been called Oldest Danish, dating from about 1100 and 1250, shows a slightly changed character, mainly depending on the system of inflections. In the second period, that of Old Danish, bringing us down to 1400, the change of the system of vowels begins to be settled, and masculine and feminine are mingled in a common gender. An indefinite article has been formed, and in the conjugation of the verb a great simplicity sets in. In the third period, 1400–1530, the influence of German upon the language is supreme, and culminates in the Reformation. The fourth period, from 1530 to about 1680, completes the work of development, and leaves the language as we at present find it.

The earliest work known to have been written in Denmark was a Latin biography of Knud the Saint, written by an English monk Ælnoth, who was attached to the church of St Alban in Odense where King Knud was murdered. Denmark produced several Latin writers of merit. Anders Sunesen (d. 1228) wrote a long poem in hexameters, *Hexaëmeron*, describing the creation. Under the auspices of Archbishop Absalon the monks of Sorö began to compile the annals of Denmark, and at the end of the 12th century Svend Aagesen, a cleric of Lund, compiled from Icelandic sources and oral tradition his *Compendiosa historia regum Daniae*. The great Saxo Grammaticus (*q.v.*) wrote his *Historia Danica* under the same patronage.

It was not till the 16th century that literature began to be generally practised in the vernacular in Denmark. The oldest laws which are still preserved date from the beginning of the 13th century, and many different collections are in existence.[1] A single work detains us in the 13th century, a treatise on medicine[2] by Henrik Harpestreng, who died in 1244. The first royal edict written in Danish is dated 1386; and the Act of Union at Kalmar, written in 1397, is the most important piece of the vernacular of the 14th century. Between 1300 and 1500, however, it is supposed that the *Kjaempeviser*, or Danish ballads, a large collection of about 500 epical and lyrical poems, were originally composed, and these form the most precious legacy of the Denmark of the middle ages, whether judged historically or poetically. We know nothing of the authors of these poems, which treat of the heroic adventures of the great warriors and lovely ladies of the chivalric age in strains of artless but often exquisite beauty. Some of the subjects are borrowed in altered form from the old mythology, while a few derive from Christian legend, and many deal with national history. The language in which we receive these ballads, however, is as late as the 16th or even the 17th century, but it is believed that they have become gradually modernized in the course of oral tradition. The first attempt to collect the ballads was made in 1591 by Anders Sörensen Vedel (1542–1616), who published 100 of them. Peder Syv printed 100 more in 1695. In 1812–1814 an elaborate collection in five volumes appeared at Christiania, edited by W. H. F. Abrahamson, R. Nyerup and K. M. Rahbek. Finally, Svend Grundtvig produced an exhaustive edition, *Danmarks gamle Folkeviser* (Copenhagen, 1853–1883, 5 vols.), which was supplemented (1891) by A. Olrik.

In 1490, the first printing press was set up at Copenhagen, by Gottfried of Gemen, who had brought it from Westphalia; and five years later the first Danish book was printed. This was the famous *Rimkrönike*[3]; a history of Denmark in rhymed Danish verse, attributed by its first editor to Niels (d. 1481), a monk of the monastery of Sorö. It extends to the death of Christian I., in 1481, which may be supposed to be approximately the date of the poem. In 1479 the university of Copenhagen had been founded. In 1506 the same Gottfried of Gemen published a famous collection of proverbs, attributed to Peder Laale. Mikkel, priest of St Alban's Church in Odense, wrote three sacred poems, *The Rose-Garland of Maiden Mary*, *The Creation* and

[1] Collected as *Samling af gamle danske Love* (5 vols., Copenhagen, 1821–1827).

[2] *Henrik Harpestraengs Laegebog* (ed. C. Molbech, Copenhagen 1826).

[3] Ed. C. Molbech (Copenhagen, 1825).

Human Life, which came out together in 1514, shortly before his death. The popular *Lucidarius* also appeared in the vulgar tongue.

These few productions appeared along with innumerable works in Latin, and dimly heralded a Danish literature. It was the Reformation that first awoke the living spirit in the popular tongue. Christiern Pedersen (*q.v.*; 1480–1554) was the first man of letters produced in Denmark. He edited and published, at Paris in 1514, the Latin text of the old chronicler, Saxo Grammaticus; he worked up in their present form the beautiful half-mythical stories of *Karl Magnus* (Charlemagne) and *Holger Danske* (Ogier the Dane). He further translated the Psalms of David and the New Testament, printed in 1529, and finally—in conjunction with Bishop Peder Palladius—the Bible, which appeared in 1550. Hans Tausen, the bishop of Ribe (1494–1561), continued Pedersen's work, but with far less literary talent. He may, however, be considered as the greatest orator and teacher of the Reformation movement. He wrote a number of popular hymns, partly original, partly translations; translated the Pentateuch from the Hebrew; and published (1536) a collection of sermons embodying the reformed doctrine and destined for the use of clergy and laity.

The Catholic party produced one controversialist of striking ability, Povel Helgesen[1] (b. *c.* 1480), also known as Paulus Eliae. He had at first been inclined to the party of reform, but when Luther broke definitely with the papal authority he became a bitter opponent. His most important polemical work is an answer (1528) to twelve questions on the religious question propounded by Gustavus I. of Sweden. He is also supposed to be the author of the *Skiby Chronicle*,[2] in which he does not confine himself to the duties of a mere annalist, but records his personal opinion of people and events. Vedel, by the edition of the *Kjaempeviser* which is mentioned above, gave an immense stimulus to the progress of literature. He published an excellent translation of Saxo Grammaticus in 1575. The first edition of a Danish *Reineke Fuchs*, by Herman Weigere, appeared at Lübeck in 1555, and the first authorized Psalter in 1559. Arild Huitfeld wrote *Chronicle of the Kingdom of Denmark*, printed in ten volumes, between 1595 and 1604.

There are few traces of dramatic effort in Denmark before the Reformation; and many of the plays of that period may be referred to the class of school comedies. Hans Sthen, a lyrical poet, wrote a morality entitled *Kortvending* ("Change of Fortune"), which is really a collection of monologues to be delivered by students. The anonymous *Ludus de Sancto Kanuto*[3] (*c.* 1530) which, in spite of its title, is written in Danish, is the earliest Danish national drama. The burlesque drama assigned to Christian Hansen, *The Faithless Wife*, is the only one of its kind that has survived. But the best of these old dramatic authors was a priest of Viborg, Justesen Ranch (1539–1607), who wrote *Kong Salomons Hylding* ("The Crowning of King Solomon") (1585), *Samsons Faengsel* ("The Imprisonment of Samson"), which includes lyrical passages which have given it claims to be considered the first Danish opera, and a farce, *Karrig Niding* ("The Miserly Miscreant"). Beside these works Ranch wrote a famous moralizing poem, entitled "A new song, of the nature and song of certain birds, in which many vices are punished, and many virtues praised." Peder Clausen[4] (1545–1614), a Norwegian by birth and education, wrote a *Description of Norway*, as well as an admirable translation of Snorri Sturlason's *Heimskringla*, published ten years after Clausen's death. The father of Danish poetry, Anders Kristensen Arrebo (1587–1637), was bishop of Trondhjem, but was deprived of his see for immorality. He was a poet of considerable genius, which is most brilliantly shown in an imitation of Du Bartas's *Divine Semaine*, the *Hexaëmeron*, a poem on the creation, in six books, which did not appear till 1661. He also made a translation of the Psalms.

He was followed by Anders Bording (1619–1677), a cheerful occasional versifier, and by Thöger Reenberg (1656–1742), a poet of somewhat higher gifts, who lived on into a later age. Among prose writers should be mentioned the grammarian Peder Syv,[5] (1631–1702); Bishop Erik Pontoppidan (1616–1678), whose *Grammatica Danica*, published in 1668, is the first systematic analysis of the language; Birgitta Thott (1610–1662), a lady who translated Seneca (1658); and Leonora Christina Ulfeld, daughter of Christian IV., who has left a touching account of her long imprisonment in her *Jammersminde*. Ole Worm (1588–1654), a learned pedagogue and antiquarian, preserved in his *Danicorum monumentorum libri sex* (Copenhagen, 1643) the descriptions of many antiquities which have since perished or been lost.

In two spiritual poets the advancement of the literature of Denmark took a further step. Thomas Kingo[6] (1634–1703) was the first who wrote Danish with perfect ease and grace. He was a Scot by descent, and retained the vital energy of his ancestors as a birthright. In 1677 he became bishop in Fünen, where he died in 1703. His *Winter Psalter* (1689), and the so-called *Kingo's Psalter* (1699), contained brilliant examples of lyrical writing, and an employment of language at once original and national. Kingo had a charming fancy, a clear sense of form and great rapidity and variety of utterance. Some of his very best hymns are in the little volume he published in 1681, and hence the old period of semi-articulate Danish may be said to close with this eventful decade, which also witnessed the birth of Holberg. The other great hymn-writer was Hans Adolf Brorson (1694–1764), who published in 1740 a great psalm-book at the king's command, in which he added his own to the best of Kingo's. Both these men held high posts in the church, one being bishop of Fünen and the other of Ribe; but Brorson was much inferior to Kingo in genius. With these names the introductory period of Danish literature ends. The language was now formed, and was being employed for almost all the uses of science and philosophy.

Ludvig Holberg (*q.v.*; 1684–1754) may be called the founder of modern Danish literature. His various works still retain their freshness and vital attraction. As an historian his style was terse and brilliant, his spirit philosophical, and his data singularly accurate. He united two unusual gifts, being at the same time the most cultured man of his day, and also in the highest degree a practical person, who clearly perceived what would most rapidly educate and interest the uncultivated. In his thirty-three dramas, sparkling comedies in prose, more or less in imitation of Molière, he has left his most important positive legacy to literature. Nor in any series of comedies in existence is decency so rarely sacrificed to a desire for popularity or a false sense of wit.

Holberg founded no school of immediate imitators, but his stimulating influence was rapid and general. The university of Copenhagen, which had been destroyed by fire in 1728, was reopened in 1742, and under the auspices of the historian Hans Gram (1685–1748), who founded the Danish Royal Academy of Sciences, it inspired an active intellectual life. Gram laid the foundation of critical history in Denmark. He brought to bear on the subject a full knowledge of documents and sources. His best work lies in his annotated editions of the older chroniclers. In 1744 Jakob Langebek (1710–1775) founded the Society for the Improvement of the Danish Language, which opened the field of philology. He began the great collection of *Scriptores rerum Danicarum medii aevi* (9 vols., Copenhagen, 1772–1878). In jurisprudence Andreas Höier (1690–1739) represented the new impulse, and in zoology Erik Pontoppidan (*q.v.*), the younger. This last name represents a lifelong activity in many branches of literature. From Holberg's college of Sorö, two learned professors, Jens Schelderup Sneedorff (1724–1764) and Jens Kraft (1720–1765), disseminated the seeds of a wider culture. All these men were aided by the generous and enlightened patronage

[1] See *Povel Eliesens danske Skrifter* (Copenhagen, 1855, &c.), edited by C. E. Secher.

[2] See *Monumenta historiae Danicae* (ed. H. Rördam, vol. i., 1873).

[3] Ed. Sophus Birket Smith (Copenhagen, 1868), who also edited the comedies ascribed to Chr. Hansen as *De tre aeldste danske Skuespil* (1874), and the works of Ranch (1876).

[4] His works were edited by Gustav Storm (Christiania, 1877–1879).

[5] See Fr. W. Horn, *Peder Syv* (Copenhagen, 1878).

[6] See A. C. L. Heiberg, *Thomas Kingo* (Odense, 1852).

of Frederick V. A little later on, the German poet Klopstock, settled in Copenhagen, bringing with him the prestige of his great reputation, and he had a strong influence in Germanizing Denmark. He founded, however, the Society for the Fine Arts, and had it richly endowed. The first prize offered was won by Christian Braumann Tullin (1728–1765) for his beautiful poem of *May-day*. Tullin, a Norwegian by birth, represents the first accession of a study of external nature in Danish poetry; he was an ardent disciple of the English poet Thomson. Christian Falster (1690–1752) wrote satires of some merit, but most of his work is in Latin. The *New Heroic Poems* of Jörgen Sorterup are notable as imitations of the old folk-literature. Ambrosius Stub [1] (1705–1758) was a lyrist of great sweetness, born before his due time, whose poems, not published till 1771, belong to a later age than their author.

The Lyrical Revival.—Between 1742 and 1749, that is to say, at the very climax of the personal activity of Holberg, several poets were born, who were destined to enrich the language with its first group of lyrical blossoms. Of these the two eldest, Wessel and Ewald, were men of extraordinary genius, and destined to fascinate the attention of posterity, not only by the brilliance of their productions, but by the suffering and brevity of their lives. Johannes Ewald (*q.v.*; 1743–1781) was not only the greatest Danish lyrist of the 18th century, but he had few rivals in the whole of Europe. As a dramatist, pure and simple, his bird-like instinct of song carried him too often into a sphere too exalted for the stage; but he has written nothing that is not stamped with the exquisite quality of distinction. Johan Herman Wessel [2] (1742–1785) excited even greater hopes in his contemporaries, but left less that is immortal behind him. After the death of Holberg, the affectation of Gallicism had reappeared in Denmark; and the tragedies of Voltaire, with their stilted rhetoric, were the most popular dramas of the day. Johan Nordahl Brun (1745–1816), a young writer who did better things later on, gave the finishing touch to the exotic absurdity by bringing out a wretched piece called *Zarina*, which was hailed by the press as the first original Danish tragedy, although Ewald's exquisite *Rolf Krage*, which truly merited that title, had appeared two years before. Wessel, who up to that time had only been known as the president of a club of wits, immediately wrote *Love without Stockings* (1772), in which a plot of the most abject triviality is worked out in strict accordance with the rules of French tragedy, and in most pompous and pathetic Alexandrines. The effect of this piece was magical; the Royal Theatre ejected its cuckoo-brood of French plays, and even the Italian opera. It was now essential that every performance should be national, and in the Danish language. To supply the place of the opera, native musicians, and especially J. P. E. Hartmann, set the dramas of Ewald and others, and thus the Danish school of music originated. Johan Nordahl Brun's best work is to be found in his patriotic songs and his hymns. He became bishop of Bergen in 1803.

Of the other poets of the revival the most important were born in Norway. Nordahl Brun, Claus Frimann (1746–1829), Claus Fasting (1746–1791), who edited a brilliant aesthetic journal, *The Critical Observer*, Christian H. Pram [3] (1756–1821), author of *Staerkodder*, a romantic epic, based on Scandinavian legend, and Edvard Storm (1749–1794), were associates and mainly fellow-students at Copenhagen, where they introduced a style peculiar to themselves, and distinct from that of the true Danes. Their lyrics celebrated the mountains and rivers of the magnificent country they had left; and, while introducing images and scenery unfamiliar to the inhabitants of monotonous Denmark, they enriched the language with new words and phrases. This group of writers is now claimed by the Norwegians as the founders of a Norwegian literature; but their true place is certainly among the Danes, to whom they primarily appealed. They added nothing to the development of the drama, except in the person of N. K. Bredal (1733–1778), who became director of the Royal Danish Theatre, and the writer of some mediocre plays.

To the same period belong a few prose writers of eminence. Werner Abrahamson (1744–1812) was the first aesthetic critic Denmark produced. Johan Clemens Tode (1736–1806) was eminent in many branches of science, but especially as a medical writer. Ove Malling (1746–1829) was an untiring collector of historical data, which he annotated in a lively style. Two historians of more definite claim on our attention are Peter Frederik Suhm (1728–1798), whose *History of Denmark* (11 vols., Copenhagen, 1782–1812) contains a mass of original material, and Ove Guldberg (1731–1808). In theology Christian Bastholm (1740–1819) and Nicolai Edinger Balle (1744–1816), bishop of Zealand, a Norwegian by birth, demand a reference. But the only really great prose-writer of the period was the Norwegian, Niels Treschow (1751–1833), whose philosophical works are composed in an admirably lucid style, and are distinguished for their depth and originality.

The poetical revival sank in the next generation to a more mechanical level. The number of writers of some talent was very great, but genius was wanting. Two intimate friends, Jonas Rein (1760–1821) and Jens Zetlitz (1761–1821), attempted, with indifferent success, to continue the tradition of the Norwegian group. Thomas Thaarup (1749–1821) was a fluent and eloquent writer of occasional poems, and of homely dramatic idylls. The early death of Ole Samsöe (1759–1796) prevented the development of a dramatic talent that gave rare promise. But while poetry languished, prose, for the first time, began to flourish in Denmark. Knud Lyne Rahbek (1760–1830) was a pleasing novelist, a dramatist of some merit, a pathetic elegist, and a witty song-writer; he was also a man full of the literary instinct, and through a long life he never ceased to busy himself with editing the works of the older poets, and spreading among the people a knowledge of Danish literature through his magazine, *Minerva*, edited in conjunction with C. H. Pram. Peter Andreas Heiberg (1758–1841) was a political and aesthetic critic of note. He was exiled from Denmark in company with another sympathizer with the principles of the French Revolution, Malte Conrad Brunn (1775–1826), who settled in Paris, and attained a world-wide reputation as a geographer. O. C. Olufsen (1764–1827) was a writer on geography, zoology and political economy. Rasmus Nyerup (1759–1829) expended an immense energy in the compilation of admirable works on the history of language and literature. From 1778 to his death he exercised a great power in the statistical and critical departments of letters. The best historian of this period, however, was Engelstoft (1774–1850), and the most brilliant theologian Bishop Mynster (1775–1854). In the annals of modern science Hans Christian Oersted (1777–1851) is a name universally honoured. He explained his inventions and described his discoveries in language so lucid and so characteristic that he claims an honoured place in the literature of the country of whose culture, in other branches, he is one of the most distinguished ornaments.

On the threshold of the romantic movement occurs the name of Jens Baggesen (*q.v.*; 1764–1826), a man of great genius, whose work was entirely independent of the influences around him. Jens Baggesen is the greatest comic poet that Denmark has produced; and as a satirist and witty lyrist he has no rival among the Danes. In his hands the difficulties of the language disappear; he performs with the utmost ease extraordinary *tours de force* of style. His astonishing talents were wasted on trifling themes and in a fruitless resistance to the modern spirit in literature.

Romanticism.—With the beginning of the 19th century the new light in philosophy and poetry, which radiated from Germany through all parts of Europe, found its way into Denmark also. In scarcely any country was the result so rapid or so brilliant. There arose in Denmark a school of poets who created for themselves a reputation in all parts of Europe, and would have done honour to any nation or any age. The splendid cultivation of metrical art threw other branches into the shade; and the epoch

[1] His collected works were edited by Fr. Barford (Copenhagen, 5th ed., 1879).

[2] Wessel's *Digte* (3rd ed., 1895) are edited by J. Levin, with a biographical introduction.

[3] A biography by his friend, K. L. Rahbek, is prefixed to a selection of his poetry (6 vols., 1824–1829).

of which we are about to speak is eminent above all for mastery over verse. The swallow who heralded the summer was a German by birth, Adolph Wilhelm Schack von Staffeldt[1] (1769–1826), who came over to Copenhagen from Pomerania, and prepared the way for the new movement. Since Ewald no one had written Danish lyrical verse so exquisitely as Schack von Staffeldt, and the depth and scientific precision of his thought won him a title which he has preserved, of being the first philosophic poet of Denmark. The writings of this man are the deepest and most serious which Denmark had produced, and at his best he yields to no one in choice and skilful use of expression. This sweet song of Schack von Staffeldt's, however, was early silenced by the louder choir that one by one broke into music around him. It was Adam Gottlob Öhlenschläger (*q.v.*; 1779–1850), the greatest poet of Denmark, who was to bring about the new romantic movement. In 1802 he happened to meet the young Norwegian Henrik Steffens (1773–1845), who had just returned from a scientific tour in Germany, full of the doctrines of Schelling. Under the immediate direction of Steffens, Öhlenschläger began an entirely new poetic style, and destroyed all his earlier verses. A new epoch in the language began, and the rapidity and matchless facility of the new poetry was the wonder of Steffens himself. The old Scandinavian mythology lived in the hands of Öhlenschläger exactly as the classical Greek religion was born again in Keats. He aroused in his people the slumbering sense of their Scandinavian nationality.

The retirement of Öhlenschläger comparatively early in life, left the way open for the development of his younger contemporaries, among whom several had genius little inferior to his own. Steen Steensen Blicher (1782–1848) was a Jutlander, and preserved all through life the characteristics of his sterile and sombre fatherland. After a struggling youth of great poverty, he published, in 1807–1809, a translation of Ossian; in 1814 a volume of lyrical poems; and in 1817 he attracted considerable attention by his descriptive poem of *The Tour in Jutland*. His real genius, however, did not lie in the direction of verse; and his first signal success was with a story, *A Village Sexton's Diary*, in 1824, which was rapidly followed by other tales, descriptive of village life in Jutland, for the next twelve years. These were collected in five volumes (1833–1836). His masterpiece is a collection of short stories, called *The Spinning Room*. He also produced many national lyrics of great beauty. But it was Blicher's use of *patois* which delighted his countrymen with a sense of freshness and strength. They felt as though they heard Danish for the first time spoken in its fulness. The poet Aarestrup (in 1848) declared that Blicher had raised the Danish language to the dignity of Icelandic. Blicher is a stern realist, in many points akin to Crabbe, and takes a singular position among the romantic idealists of the period, being like them, however, in the love of precise and choice language, and hatred of the mere commonplaces of imaginative writing.[2]

Nikolai Frederik Severin Grundtvig (*q.v.*; 1783–1872), like Öhlenschläger, learned the principles of the German romanticism from the lips of Steffens. He adopted the idea of introducing the Old Scandinavian element into art, and even into life, still more earnestly than the older poet. Bernhard Severin Ingemann (*q.v.*; 1789–1862) contributed to Danish literature historical romances in the style of Sir Walter Scott. Johannes Carsten Hauch (*q.v.*; 1790–1872) first distinguished himself as a disciple of Öhlenschläger, and fought under him in the strife against the old school and Baggesen. But the master misunderstood the disciple; and the harsh repulse of Öhlenschläger silenced Hauch for many years. He possessed, however, a strong and fluent genius, which eventually made itself heard in a multitude of volumes, poems, dramas and novels. All that Hauch wrote is marked by great qualities, and by distinction; he had a native bias towards the mystical, which, however, he learned to keep in abeyance.

[1] See P. L. Liebenberg, *Schack Staffeldts samlede Digte* (2 vols., Copenhagen, 1843), and *Samlinger til Schack Staffeldts Levnet* (4 vols., 1846–1851).

[2] Blicher's *Tales* were edited by P. Hansen (3 vols., Copenhagen, 1871), and his *Poems* in 1870.

Johan Ludvig Heiberg (*q.v.*; 1791–1860) was a critic who ruled the world of Danish taste for many years. His mother, the Baroness Gyllembourg-Ehrensvärd (*q.v.*; 1773–1856), wrote a large number of anonymous novels. Her knowledge of life, her sparkling wit and her almost faultless style, make these short stories masterpieces of their kind.

Christian Hviid Bredahl (1784–1860) produced six volumes of *Dramatic Scenes*[3] (1819–1833) which, in spite of their many brilliant qualities, were little appreciated at the time. Bredahl gave up literature in despair to become a peasant farmer, and died in poverty.

Ludvig Adolf Bödtcher (1793–1874) wrote a single volume of lyrical poems, which he gradually enlarged in succeeding editions. He was a consummate artist in verse, and his impressions are given with the most delicate exactitude of phrase, and in a very fine strain of imagination. He was a quietist and an epicurean, and the closest parallel to Horner in the literature of the North. Most of Bödtcher's poems deal with Italian life, which he learned to know thoroughly during a long residence in Rome. He was secretary to Thorwaldsen for a considerable time.

Christian Winther (*q.v.*; 1796–1876) made the island of Zealand his loving study, and that province of Denmark belongs to him no less thoroughly than the Cumberland lakes belong to Wordsworth. Between the latter poet and Winther there was much resemblance. He was, without compeer, the greatest pastoral lyrist of Denmark. His exquisite strains, in which pure imagination is blended with most accurate and realistic descriptions of scenery and rural life, have an extraordinary charm not easily described.

The youngest of the great poets born during the last twenty years of the 18th century was Henrik Hertz (*q.v.*; 1797–1870). As a satirist and comic poet he followed Baggesen, and in all branches of the poetic art stood a little aside out of the main current of romanticism. He introduced into the Danish literature of his time inestimable elements of lucidity and purity. In his best pieces Hertz is the most modern and most cosmopolitan of the Danish writers of his time.

It is noticeable that all the great poets of the romantic period lived to an advanced age. Their prolonged literary activity—for some of them, like Grundtvig, were busy to the last—had a slightly damping influence on their younger contemporaries, but certain names in the next generation have special prominence. Hans Christian Andersen (*q.v.*; 1805–1875) was the greatest of modern fabulists. In 1835 there appeared the first collection of his *Fairy Tales*, and won him a world-wide reputation. Almost every year from this time forward until near his death he published about Christmas time one or two of these unique stories, so delicate in their humour and pathos, and so masterly in their simplicity. Carl Christian Bagger (1807–1846) published volumes in 1834 and 1836 which gave promise of a great future,—a promise broken by his early death. Frederik Paludan-Müller (*q.v.*; 1809–1876) developed, as a poet, a magnificent career, which contrasted in its abundance with his solitary and silent life as a man. His mythological or pastoral dramas, his great satiric epos of *Adam Homo* (1841–1848), his comedies, his lyrics, and above all his noble philosophic tragedy of *Kalanus*, prove the immense breadth of his compass, and the inexhaustible riches of his imagination. C. L. Emil Aarestrup (1800–1856) published in 1838 a volume of vivid erotic poetry, but its quality was only appreciated after his death. Edvard Lembcke (1815–1897) made himself famous as the admirable translator of Shakespeare, but the incidents of 1864 produced from him some volumes of direct and manly patriotic verse.

The poets completely ruled the literature of Denmark during this period. There were, however, eminent men in other departments of letters, and especially in philology. Rasmus Christian Rask (1787–1832) was one of the most original and gifted linguists of his age. His grammars of Old Frisian, Icelandic and Anglo-Saxon were unapproached in his own time, and are still admirable. Niels Matthias Petersen (1794–1862), a disciple of Rask, was the author of an admirable *History of Denmark in the Heathen*

[3] Edited (3 vols., 2nd ed., 1855, Copenhagen) by F. L. Liebenberg.

Antiquity, and the translator of many of the sagas. Martin Frederik Arendt (1773–1823), the botanist and archaeologist, did much for the study of old Scandinavian records. Christian Molbech (1783–1857) was a laborious lexicographer, author of the first good Danish dictionary, published in 1833. In Joachim Frederik Schouw (1789–1852), Denmark produced a very eminent botanist, author of an exhaustive *Geography of Plants*. In later years he threw himself with zeal into politics. His botanical researches were carried on by Frederik Liebmann (1813–1856). The most famous zoologist contemporary with these men was Salomon Dreier (1813–1842).

The romanticists found their philosopher in a most remarkable man, Sören Aaby Kierkegaard (1813–1855), one of the most subtle thinkers of Scandinavia, and the author of some brilliant philosophical and polemical works. A learned philosophical writer, not to be compared, however, for genius or originality to Kierkegaard, was Frederik Christian Sibbern (1785–1872). He wrote a dissertation *On Poetry and Art* (3 vols., 1853–1869) and *The Contents of a MS. from the Year 2135* (3 vols., 1858–1872).

Among novelists who were not also poets was Andreas Nikolai de Saint-Aubain (1798–1865), who, under the pseudonym of Carl Bernhard, wrote a series of charming romances. Mention must also be made of two dramatists, Peter Thun Feorsom (1777–1817), who produced an excellent translation of Shakespeare (1807–1816), and Thomas Overskou (1798–1873), author of a long series of successful comedies, and of a history of the Danish theatre (5 vols., Copenhagen, 1854–1864).

Other writers whose names connect the age of romanticism with a later period were Meyer Aron Goldschmidt (1819–1887), author of novels and tales; Herman Frederik Ewald (1821–1908), who wrote a long series of historical novels; Jens Christian Hostrup (1818–1892), a writer of exquisite comedies; and the miscellaneous writer Erik Bögh (1822–1899). In zoology, J. J. S. Steenstrup (1813–1898); in philology, J. N. Madvig (1804–1886) and his disciple V. Thomsen (b. 1842); in antiquarianism, C. J. Thomsen (1788–1865) and J. J. Asmussen Worsaae (1821–1885); and in philosophy, Rasmus Nielsen (1809–1884) and Hans Bröchner (1820–1875), deserve mention.

The development of imaginative literature in Denmark became very closely defined during the latter half of the 19th century. The romantic movement culminated in several poets of great eminence, whose deaths prepared the way for a new school. In 1874 Bödtcher passed away, in 1875 Hans Christian Andersen, in the last week of 1876 Winther, and the greatest of all, Frederik Paludan-Müller. The field was therefore left open to the successors of those idealists, and in 1877 the reaction began to be felt. The eminent critic, Dr Georg Brandes (*q.v.*), had long foreseen the decline of pure romanticism, and had advocated a more objective and more exact treatment of literary phenomena. Accordingly, as soon as all the great planets had disappeared, a new constellation was perceived to have risen, and all the stars in it had been lighted by the enthusiasm of Brandes. The new writers were what he called Naturalists, and their sympathies were with the latest forms of exotic, but particularly of French literature. Among these fresh forces three immediately took place as leaders—Jacobsen, Drachmann and Schandorph. In J. P. Jacobsen (*q.v.*; 1847–1885) Denmark was now taught to welcome the greatest artist in prose which she has ever possessed; his romance of *Marie Grubbe* led off the new school with a production of unexampled beauty. But Jacobsen died young, and the work was really carried out by his two companions. Holger Drachmann (*q.v.*; 1846–1908) began life as a marine painter; and a first little volume of poems, which he published in 1872, attracted slight attention. In 1877 he came forward again with one volume of verse, another of fiction, a third of travel; in each he displayed great vigour and freshness of touch, and he rose at one leap to the highest position among men of promise. Drachmann retained his place, without rival, as the leading imaginative writer in Denmark. For many years he made the aspects of life at sea his particular theme, and he contrived to rouse the patriotic enthusiasm of the Danish public as it had never been roused before. His various and unceasing productiveness, his freshness and vigour, and the inexhaustible richness of his lyric versatility, early brought Drachmann to the front and kept him there. Meanwhile prose imaginative literature was ably supported by Sophus Schandorph (1836–1901), who had been entirely out of sympathy with the idealists, and had taken no step while that school was in the ascendant. In 1876, in his fortieth year, he was encouraged by the change in taste to publish a volume of realistic stories, *Country Life*, and in 1878 a novel, *Without a Centre*. He has some relation with Guy de Maupassant as a close analyst of modern types of character, but he has more humour. He has been compared with such Dutch painters of low life as Teniers. His talent reached its height in the novel called *Little Folk* (1880), a most admirable study of lower middle-class life in Copenhagen. He was for a while, without doubt, the leading living novelist, and he went on producing works of great force, in which, however, a certain monotony is apparent. The three leaders had meanwhile been joined by certain younger men who took a prominent position. Among these Karl Gjellerup and Erik Skram were the earliest. Gjellerup (b. 1857), whose first works of importance date from 1878, was long uncertain as to the direction of his powers; he was poet, novelist, moralist and biologist in one; at length he settled down into line with the new realistic school, and produced in 1882 a satirical novel of manners which had a great success, *The Disciple of the Teutons*. Erik Skram (b. 1847) had in 1879 written a solitary novel, *Gertrude Coldbjörnsen*, which created a sensation, and was hailed by Brandes as exactly representing the "naturalism" which he desired to see encouraged; but Skram has written little else of importance. Other writers of reputation in the naturalistic school were Edvard Brandes (b. 1847), and Herman Bang (b. 1858). Peter Nansen (b. 1861) has come into wide notoriety as the author, in particularly beautiful Danish, of a series of stories of a pronouncedly sexual type, among which *Maria* (1894) has been the most successful. Meanwhile, several of the elder generation, unaffected by the movement of realism, continued to please the public. Three lyrical poets, H. V. Kaalund (1818–1885), Carl Ploug (1813–1894) and Christian Richardt (1831–1892), of very great talent, were not yet silent, and among the veteran novelists were still active H. F. Ewald and Thomas Lange (1829–1887). Ewald's son Carl (1856–1908) achieved a great name as a novelist, but did his most characteristic work in a series of books for children, in which he used the fairy tale, in the manner of Hans Andersen, as a vehicle for satire and a theory of morals. During the whole of this period the most popular writer of Denmark was J. C. C. Brosböll (1816–1900), who wrote, under the pseudonym Carit Etlar, a vast number of tales. Another popular novelist was Vilhelm Bergsöe (b. 1835), author of *In the Sabine Mountains* (1871), and other romances. Sophus Bauditz (b. 1850) persevered in composing novels which attain a wide general popularity. Mention must be made also of the dramatist Christian Molbech (1821–1888).

Between 1885 and 1892 there was a transitional period in Danish literature. Up to that time all the leaders had been united in accepting the naturalistic formula, which was combined with an individualist and a radical tendency. In 1885, however, Drachmann, already the recognized first poet of the country, threw off his allegiance to Brandes, denounced the exotic tradition, declared himself a Conservative, and took up a national and patriotic attitude. He was joined a little later by Gjellerup, while Schandorph remained stanchly by the side of Brandes. The camp was thus divided. New writers began to make their appearance, and, while some of these were stanch to Brandes, others were inclined to hold rather with Drachmann. Of the authors who came forward during this period of transition, the strongest novelist proved to be Hendrik Pontoppidan (b. 1857). In some of his books he reminds the reader of Turgeniev. Pontoppidan published in 1898 the first volume of a great novel entitled *Lykke-Per*, the biography of a typical Jutlander named Per Sidenius, a work to be completed in eight volumes. From 1893 to 1909 no great features of a fresh kind revealed themselves. The Danish public, grown tired of realism, and satiated with pathological phenomena, returned to a fresh study of their own national

characteristics. The cultivation of verse, which was greatly discouraged in the eighties, returned. Drachmann was supported by excellent younger poets of his school. J. J. Jörgensen (b. 1866), a Catholic decadent, was very prolific. Otto C. Fönss (b. 1853) published seven little volumes of graceful lyrical poems in praise of gardens and of farm-life. Andreas Dolleris (b. 1850), of Vejle, showed himself an occasional poet of merit. Alfred Ipsen (b. 1852) must also be mentioned as a poet and critic. Valdemar Rördam, whose *The Danish Tongue* was the lyrical success of 1901, may also be named. Some attempts were made to transplant the theories of the symbolists to Denmark, but without signal success. On the other hand, something of a revival of naturalism is to be observed in the powerful studies of low life admirably written by Karl Larsen (b. 1860).

The drama has long flourished in Denmark. The principal theatres are liberally open to fresh dramatic talent of every kind, and the great fondness of the Danes for this form of entertainment gives unusual scope for experiments in halls or private theatres; nothing is too eccentric to hope to obtain somewhere a fair hearing. Drachmann produced with very great success several romantic dramas founded on the national legends. Most of the novelists and poets already mentioned also essayed the stage, and to those names should be added these of Einar Christiansen (b. 1861), Ernst von der Recke (b. 1848), Oskar Benzon (b. 1856) and Gustav Wied (b. 1858).

In theology no names were as eminent as in the preceding generation, in which such writers as H. N. Clausen (1793–1877), and still more Hans Larsen Martensen (1808–1884), lifted the prestige of Danish divinity to a high point. But in history the Danes have been very active. Karl Ferdinand Allen (1811–1871) began a comprehensive history of the Scandinavian kingdoms (5 vols., 1864–1872). Jens Peter Trap (1810–1885) concluded his great statistical account of Denmark in 1879. The 16th century was made the subject of the investigations of Troels Lund (*q.v.*). About 1880 several of the younger historians formed the plan of combining to investigate and publish the sources of Danish history; in this the indefatigable Johannes Steenstrup (b. 1844) was prominent. The domestic history of the country began, about 1885, to occupy the attention of Edvard Holm (b. 1833), O. Nielsen and the veteran P. Frederik Barfod (1811–1896). The naval histories of G. Lütken attracted much notice. Besides the names already mentioned, A. D. Jörgensen (1840–1897), J. Fredericia (b. 1849), Christian Erslev (b. 1852) and Vilhelm Mollerup have all distinguished themselves in the excellent school of Danish historians. In 1896 an elaborate composite history of Denmark was undertaken by some leading historians (pub. 1897–1905). In philosophy nothing has recently been published of the highest value. Martensen's *Jakob Böhme* (1881) belongs to an earlier period. H. Höffding (b. 1843) has been the most prominent contributor to psychology. His *Problems of Philosophy* and his *Philosophy of Religion* were translated into English in 1906. Alfred Lehmann (b. 1858) has, since 1896, attracted a good deal of attention by his sceptical investigation of psychical phenomena. F. Rönning has written on the history of thought in Denmark. In the criticism of art, Julius Lange (1838–1896), and later Karl Madsen, have done excellent service. In literary criticism Dr Georg Brandes is notable for the long period during which he remained predominant. His was a steady and stimulating presence, ever pointing to the best in art and thought, and his influence on his age was greater than that of any other Dane.

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DENNERY, or D'ENNERY, **ADOLPHE** (1811–1899), French dramatist and novelist, whose real surname was PHILIPPE, was born in Paris on the 17th of June 1811. He obtained his first success in collaboration with Charles Desnoyer in *Émile, ou le fils d'un pair de France* (1831), a drama which was the first of a series of some two hundred pieces written alone or in collaboration with other dramatists. Among the best of them may be mentioned *Gaspard Hauser* (1838) with Anicet Bourgeois; *Les Bohémiens de Paris* (1842) with Eugène Grangé; with Mallian, *Marie-Jeanne, ou la femme du peuple* (1845), in which Madame Dorval obtained a great success; *La Case d'Oncle Tom* (1853); *Les Deux Orphelines* (1875), perhaps his best piece, with Eugène Cormon. He wrote the libretto for Gounod's *Tribut de Zamora* (1881); with Louis Gallet and Edouard Blan he composed the book of Massenet's *Cid* (1885); and, again in collaboration with Eugène Cormon, the books of Auber's operas, *Le Premier Jour de bonheur* (1868) and *Rêve d'amour* (1869). He prepared for the stage Balzac's posthumous comedy *Mercadet ou le faiseur*, presented at the Gymnase theatre in 1851. Reversing the usual order of procedure, Dennery adapted some of his plays to the form of novels. He died in Paris in 1899.

DENNEWITZ, a village of Germany, in the Prussian province of Brandenburg, near Jüterbog, 40 m. S.W. from Berlin. It is memorable as the scene of a decisive battle on the 6th of September 1813, in which Marshal Ney, with an army of 58,000 French, Saxons and Poles, was defeated with great loss by 50,000 Prussians under Generals Bülow (afterwards Count Bülow of Dennewitz) and Tauentzien. The site of the battle is marked by an iron obelisk.

DENNIS, JOHN (1657–1734), English critic and dramatist, the son of a saddler, was born in London in 1657. He was educated at Harrow School and Caius College, Cambridge, where he took his B.A. degree in 1679. In the next year he was fined and dismissed from his college for having wounded a fellow-student with a sword. He was, however, received at Trinity Hall, where he took his M.A. degree in 1683. After travelling in France and Italy, he settled in London, where he became acquainted with Dryden, Wycherley and others; and being made temporarily independent by inheriting a small fortune, he devoted himself to literature. The duke of Marlborough procured him a place as one of the queen's waiters in the customs with a salary of £120 a year. This he afterwards disposed of for a small sum, retaining, at the suggestion of Lord Halifax, a yearly charge upon it for a long term of years. Neither the poems nor the plays of Dennis are of any account, although one of his tragedies, a violent attack on the French in harmony with popular prejudice, entitled *Liberty Asserted*, was produced with great success at Lincoln's Inn Fields in 1704. His sense of his own importance approached mania, and he is said to have desired the duke of Marlborough to have a special clause inserted in the treaty of Utrecht to secure him from French vengeance. Marlborough pointed out that although he had been a still greater enemy of the French nation, he had no fear for his own security. This tale and others of a similar nature may well be exaggerations prompted by his enemies, but the infirmities of character and temper indicated in them were real. Dennis is best remembered as a critic, and Isaac D'Israeli, who took a by no means favourable view of Dennis, said that some of his criticisms attain classical rank. The earlier ones, which have nothing of the rancour that afterwards gained him the nickname of "Furius," are the best. They are *Remarks . . .* (1696), on Blackmore's epic of Prince Arthur; *Letters upon Several Occasions written by and between Mr Dryden, Mr Wycherley, Mr Moyle, Mr Congreve and Mr Dennis, published by Mr Dennis* (1696); two pamphlets in reply to Jeremy Collier's *Short View; The Advancement and Reformation of*

Modern Poetry (1701), perhaps his most important work; *The Grounds of Criticism in Poetry* (1704), in which he argued that the ancients owed their superiority over the moderns in poetry to their religious attitude; an *Essay upon Publick Spirit* . . . (1711), in which he inveighs against luxury, and servile imitation of foreign fashions and customs; and *Essay on the Genius and Writings of Shakespeare in three Letters* (1712).

Dennis had been offended by a humorous quotation made from his works by Addison, and published in 1713 *Remarks upon Cato*. Much of this criticism was acute and sensible, and it is quoted at considerable length by Johnson in his *Life of Addison*, but there is no doubt that Dennis was actuated by personal jealousy of Addison's success. Pope replied in *The Narrative of Dr Robert Norris, concerning the strange and deplorable frenzy of John Dennis* . . . (1713). This pamphlet was full of personal abuse, exposing Dennis's foibles, but offering no defence of *Cato*. Addison repudiated any connivance in this attack, and indirectly notified Dennis that when he did answer his objections, it would be without personalities. Pope had already assailed Dennis in 1711 in the *Essay on Criticism*, as Appius. Dennis retorted by *Reflections, Critical and Satirical* . . . , a scurrilous production in which he taunted Pope with his deformity, saying among other things that he was "as stupid and as venomous as a hunch-backed toad." He also wrote in 1717 *Remarks upon Mr Pope's Translation of Homer* . . . and *A True Character of Mr Pope*. He accordingly figures in the *Dunciad*, and in a scathing note in the edition of 1729 (bk. i. 1. 106) Pope quotes his more outrageous attacks, and adds an insulting epigram attributed to Richard Savage, but now generally ascribed to Pope. More pamphlets followed, but Dennis's day was over. He outlived his annuity from the customs, and his last years were spent in great poverty. Bishop Atterbury sent him money, and he received a small sum annually from Sir Robert Walpole. A benefit performance was organized at the Haymarket (December 18, 1733) on his behalf. Pope wrote for the occasion an ill-natured prologue which Cibber recited. Dennis died within three weeks of this performance, on the 6th of January 1734.

His other works include several plays, for one of which, *Appius and Virginia* (1709), he invented a new kind of thunder. He wrote a curious *Essay on the Operas after the Italian Manner* (1706), maintaining that opera was the outgrowth of effeminate manners, and should, as such, be suppressed. His *Works* were published in 1702, *Select Works* . . . (2 vols.) in 1718, and *Miscellaneous Tracts*, the first volume only of which appeared, in 1727. For accounts of Dennis see Cibber's *Lives of the Poets*, vol. iv.; Isaac D'Israeli's essays on Pope and Addison in the *Quarrels of Authors*, and "On the Influence of a Bad Temper in Criticism" in *Calamities of Authors*; and numerous references in Pope's *Works*.

DENOMINATION (Lat. *denominare*, to give a specific name to), the giving of a specific name to anything, hence the name or designation of a person or thing, and more particularly of a class of persons or things; thus, in arithmetic, it is applied to a unit in a system of weights and measures, currency or numbers. The most general use of "denomination" is for a body of persons holding specific opinions and having a common name, especially with reference to the religious opinions of such a body. More particularly the word is used of the various "sects" into which members of a common religious faith may be divided. The term "denominationalism" is thus given to the principle of emphasizing the distinctions, rather than the common ground, in the faith held by different bodies professing one sort of religious belief. This use is particularly applied to that system of religious education which lays stress on the principle that children belonging to a particular religious sect should be publicly taught in the tenets of their belief by members belonging to it and under the general control of the ministers of the denomination.

DENON, DOMINIQUE VIVANT, Baron de (1747–1825), French artist and archaeologist, was born at Chalon-sur-Saône on the 4th of January 1747. He was sent to Paris to study law, but he showed a decided preference for art and literature, and soon gave up his profession. In his twenty-third year he produced a comedy, *Le Bon Père*, which obtained a *succès d'estime*, as he had already won a position in society by his agreeable manners and exceptional conversational powers. He became a favourite of Louis XV., who entrusted him with the collection and arrangement of a cabinet of medals and antique gems for Madame de Pompadour, and subsequently appointed him attaché to the French embassy at St Petersburg. On the accession of Louis XVI. Denon was transferred to Sweden; but he returned, after a brief interval, to Paris with the ambassador M. de Vergennes, who had been appointed foreign minister. In 1775 Denon was sent on a special mission to Switzerland, and took the opportunity of visiting Voltaire at Ferney. He made a portrait of the philosopher, which was engraved and published on his return to Paris. His next diplomatic appointment was to Naples, where he spent seven years, first as secretary to the embassy and afterwards as *chargé d'affaires*. He devoted this period to a careful study of the monuments of ancient art, collecting many specimens and making drawings of others. He also perfected himself in etching and mezzotinto engraving. The death of his patron, M. de Vergennes, in 1787, led to his recall, and the rest of his life was given mainly to artistic pursuits. On his return to Paris he was admitted a member of the Academy of Painting. After a brief interval he returned to Italy, living chiefly at Venice. He also visited Florence and Bologna, and afterwards went to Switzerland. While there he heard that his property had been confiscated, and his name placed on the list of the proscribed, and with characteristic courage he resolved at once to return to Paris. His situation was critical, but he was spared, thanks to the friendship of the painter David, who obtained for him a commission to furnish designs for republican costumes. When the Revolution was over, Denon was one of the band of eminent men who frequented the house of Madame de Beauharnais. Here he met Bonaparte, to whose fortunes he wisely attached himself. At Bonaparte's invitation he joined the expedition to Egypt, and thus found the opportunity of gathering the materials for his most important literary and artistic work. He accompanied General Desaix to Upper Egypt, and made numerous sketches of the monuments of ancient art, sometimes under the very fire of the enemy. The results were published in his *Voyage dans la basse et la haute Égypte* (2 vols. fol., with 141 plates, Paris, 1802), a work which crowned his reputation both as an archaeologist and as an artist. In 1804 he was appointed by Napoleon to the important office of director-general of museums, which he filled until the restoration in 1815, when he had to retire. He was a devoted friend of Napoleon, whom he accompanied in his expeditions to Austria, Spain and Poland, taking sketches with his wonted fearlessness on the various battlefields, and advising the conqueror in his choice of spoils of art from the various cities pillaged. After his retirement he began an illustrated history of ancient and modern art, in which he had the co-operation of several skilful engravers. He died at Paris on the 27th of April 1825, leaving the work unfinished. It was published posthumously, with an explanatory text by Amaury Duval, under the title *Monuments des arts du dessin chez les peuples tant anciens que modernes, recueillis par Vivant Denon* (4 vols. fol., Paris, 1829). Denon was the author of a novel, *Point de lendemain* (1777), of which further editions were printed in 1812, 1876 and 1879.

See J. Renouvier, *Histoire de l'art pendant la Révolution*; A. de la Fizelière, *L'Œuvre originale de Vivant-Denon* (2 vols., Paris, 1872–1873); Roger Portallis, *Les Dessinateurs d'illustrations au XVIII^e siècle*; D. H. Beraldi, *Les Graveurs d'illustrations au XVIII^e siècle*.

DENOTATION (from Lat. *denotare*, to mark out, specify), in logic, a technical term used strictly as the correlative of Connotation, to describe one of the two functions of a concrete term. The concrete term "connotes" attributes and "denotes" all the individuals which, as possessing these attributes, constitute the genus or species described by the term. Thus "cricketer" denotes the individuals who play cricket, and connotes the qualities or characteristics by which these individuals are marked. In this sense, in which it was first used by J. S. Mill, Denotation is equivalent to Extension, and Connotation to Intension. It is clear that when the given term is qualified by a limiting adjective the Denotation or Extension diminishes, while the Connotation or Intension increases; *e.g.* a generic term like "flower" has a larger Extension, and a smaller Intension than "rose"; "rose"

than "moss-rose." In more general language Denotation is used loosely for that which is meant or indicated by a word, phrase, sentence or even an action. Thus a proper name or even an abstract term is said to have Denotation. (See CONNOTATION.)

DENS, PETER (1690–1775), Belgian Roman Catholic theologian, was born at Boom near Antwerp. Most of his life was spent in the archiepiscopal college of Malines, where he was for twelve years reader in theology and for forty president. His great work was the *Theologia moralis et dogmatica*, a compendium in catechetical form of Roman Catholic doctrine and ethics which has been much used as a students' text-book. Dens died on the 15th of February 1775.

DENSITY (Lat. *densus*, thick), in physics, the mass or quantity of matter contained in unit volume of any substance: this is the *absolute density*; the term *relative density* or *specific gravity* denotes the ratio of the mass of a certain volume of a substance to the mass of the same volume of some standard substance. Since the weights used in conjunction with a balance are really standard masses, the word "weight" may be substituted for the word "mass" in the preceding definitions; and we may symbolically express the relations thus:—If M be the weight of substance occupying a volume V, then the absolute density $\Delta = M/V$; and if m, m_1 be the weights of the substance and of the standard substance which occupy the same volume, the relative density or specific gravity $S = m/m_1$; or more generally if m_1 be the weight of a volume v of the substance, and m_1 the weight of a volume v_1 of the standard, then $S = mv_1/m_1v$. In the numerical expression of absolute densities it is necessary to specify the units of mass and volume employed; while in the case of relative densities, it is only necessary to specify the standard substance, since the result is a mere number. Absolute densities are generally stated in the C.G.S. system, *i.e.* as grammes per cubic centimetre. In commerce, however, other expressions are met with, as, for example, "pounds per cubic foot" (used for woods, metals, &c.), "pounds per gallon," &c. The standard substances employed to determine relative densities are: water for liquids and solids, and hydrogen or atmospheric air for gases; oxygen (as 16) is sometimes used in this last case. Other standards of reference may be used in special connexions; for example, the Earth is the usual unit for expressing the relative density of the other members of the solar system. Reference should be made to the article GRAVITATION for an account of the methods employed to determine the "mean density of the earth."

In expressing the absolute or relative density of any substance, it is necessary to specify the conditions for which the relation holds: in the case of gases, the temperature and pressure of the experimental gas (and of the standard, in the case of relative density); and in the case of solids and liquids, the temperature. The reason for this is readily seen; if a mass M of any gas occupies a volume V at a temperature T (on the absolute scale) and a pressure P, then its absolute density under these conditions is $\Delta = M/V$; if now the temperature and pressure be changed to T_1 and P_1, the volume V_1 under these conditions is VPT/P_1T_1, and the absolute density is MP_1T/VPT_1. It is customary to reduce gases to the so-called "normal temperature and pressure," abbreviated to N.T.P., which is 0° C. and 760 mm.

The relative densities of gases are usually expressed in terms of the standard gas under the same conditions. The density gives very important information as to the molecular weight, since by the law of Avogadro it is seen that the relative density is the ratio of the molecular weights of the experimental and standard gases. In the case of liquids and solids, comparison with water at 4° C., the temperature of the maximum density of water; at 0° C., the zero of the Centigrade scale and the freezing-point of water; at 15° and 18°, ordinary room-temperatures; and at 25°, the temperature at which a thermostat may be conveniently maintained, are common in laboratory practice. The temperature of the experimental substance may or may not be the temperature of the standard. In such cases a bracketed fraction is appended to the specific gravity, of which the numerator and denominator are respectively the temperatures of the substance and of the standard; thus 1·093(0°/4°) means that the ratio of the weight of a definite volume of a substance at 0° to the weight of the same volume of water at 4° is 1·093. It may be noted that if comparison be made with water at 4°, the relative density is the same as the absolute density, since the unit of mass in the C.G.S. system is the weight of a cubic centimetre of water at this temperature. In British units, especially in connexion with the statement of relative densities of alcoholic liquors for Inland Revenue purposes, comparison is made with water at 62° F. (16·6 C.); a reason for this is that the gallon of water is defined by statute as weighing 10 lb at 62° F., and hence the densities so expressed admit of the ready conversion of volumes to weights. Thus if d be the relative density, then $10d$ represents the weight of a gallon in lb. The brewer has gone a step further in simplifying his expressions by multiplying the density by 1000, and speaking of the difference between the density so expressed and 1000 as "degrees of gravity" (see BEER).

PRACTICAL DETERMINATION OF DENSITIES

The methods for determining densities may be divided into two groups according as hydrostatic principles are employed or not. In the group where the principles of hydrostatics are not employed the method consists in determining the weight and volume of a certain quantity of the substance, or the weights of equal volumes of the substance and of the standard. In the case of solids we may determine the volume in some cases by direct measurement this gives at the best a very rough and ready value; a better method is to immerse the body in a fluid (in which it must sink and be insoluble) contained in a graduated glass, and to deduce its volume from the height to which the liquid rises. The weight may be directly determined by the balance. The ratio "weight to volume" is the absolute density. The separate determination of the volume and mass of such substances as gunpowder, cotton-wool, soluble substances, &c., supplies the only means of determining their densities. The stereometer of Say, which was greatly improved by Regnault and further modified by Kopp, permits an accurate determination of the volume of a given mass of any such substance. In its simplest form the instrument consists of a glass tube PC (fig. 1), of uniform bore, terminating in a cup PE, the mouth of which can be rendered air-tight by the plate of glass E. The substance whose volume is to be determined is placed in the cup PE, and the tube PC is immersed in the vessel of mercury D, until the mercury reaches the mark P. The plate E is then placed on the cup, and the tube PC raised until the surface of the mercury in the tube stands at M, that in the vessel D being at C, and the height MC is measured. Let h denote this height, and let PM be denoted by l. Let u represent the volume of air in the cup before the body was inserted, v the volume of the body, a the area of the horizontal section of the tube PC, and k the height of the mercurial barometer. Then, by Boyle's law $(u - v + al)(h - k) = (u - v)h$, and therefore $v = u - al(h - k)/k$.

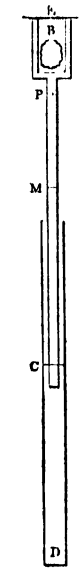

FIG. 1.—Say's Stereometer.

The volume u may be determined by repeating the experiment when only air is in the cup. In this case $v = 0$, and the equation becomes $(u + al')(h - k') = uh$, whence $u = al'(h - k')/k'$. Substituting this value in the expression for v, the volume of the body inserted in the cup becomes known. The chief errors to which the stereometer is liable are (1) variation of temperature and atmospheric pressure during the experiment, and (2) the presence of moisture which disturbs Boyle's law.

The method of weighing equal volumes is particularly applicable to the determination of the relative densities of liquids. It consists in weighing a glass vessel (1) empty, (2) filled with the liquid, (3) filled with the standard substance. Calling the weight of the empty vessel w, when filled with the liquid W, and when filled with the standard substance W_1, it is obvious that $W - w$, and $W_1 - w$, are the weights of equal volumes of the liquid and standard, and hence the relative density is $(W - w)/(W_1 - w)$.

Many forms of vessels have been devised. The commoner type of "specific gravity bottle" consists of a thin glass bottle (fig. 2) of a capacity varying from 10 0100 cc., fitted with an accurately ground stopper, which is vertically perforated by a fine hole. The bottle is carefully cleansed by washing with soda, hydrochloric acid and distilled water, and then dried by heating in an air bath or by blowing in warm air. It is allowed to cool and then weighed. The bottle is then filled with distilled water, and brought to a definite temperature by immersion in a thermostat, and the stopper inserted. It is removed from the thermostat, and carefully

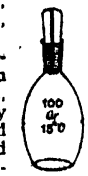

FIG. 2.

wiped. After cooling it is weighed. The bottle is again cleaned and dried, and the operations repeated with the liquid under examination instead of water. Numerous modifications of this bottle are in use. For volatile liquids, a flask provided with a long neck which carries a graduation and is fitted with a well-ground stopper is recommended. The bringing of the liquid to the mark is effected by removing the excess by means of a capillary. In many forms a thermometer forms part of the apparatus.

Another type of vessel, named the Sprengel tube or pycnometer (Gr. πυκνός, dense), is shown in fig. 3. It consists of a cylindrical tube of a capacity ranging from 10 to 50 cc., provided at the upper end with a thick-walled capillary bent as shown on the left of the figure. From the bottom there leads another fine tube, bent upwards, and then at right angles so as to be at the same level as the capillary branch. This tube bears a graduation. A loop of platinum wire passed under these tubes serves to suspend the vessel from the balance arm. The manner of cleansing, &c., is the same as in the ordinary form. The vessel is filled by placing the capillary in a vessel containing the liquid and gently aspirating. Care must be taken that no air bubbles are enclosed. The liquid is adjusted to the mark by withdrawing any excess from the capillary end by a strip of bibulous paper or by a capillary tube. Many variations of this apparatus are in use; in one of the commonest there are two cylindrical chambers, joined at the bottom, and each provided at the top with fine tubes bent at right angles; sometimes the inlet and outlet tubes are provided with caps.

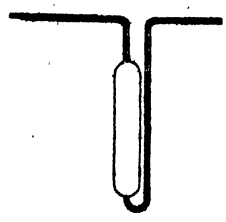

FIG. 3.

The specific gravity bottle may be used to determine the relative density of a solid which is available in small fragments, and is insoluble in the standard liquid. The method involves three operations:—(1) weighing the solid in air (W), (2) weighing the specific gravity bottle full of liquid (W_1), (3) weighing the bottle containing the solid and filled up with liquid (W_2). It is readily seen that $W+W_1-W_2$ is the weight of the liquid displaced by the solid, and therefore is the weight of an equal volume of liquid; hence the relative density is $W/(W+W_1-W_2)$.

The determination of the absolute densities of gases can only be effected with any high degree of accuracy by a development of this method. As originated by Regnault, it consisted in filling a large glass globe with the gas by alternately exhausting with an air-pump and admitting the pure and dry gas. The flask was then brought to 0° by immersion in melting ice, the pressure of the gas taken, and the stop-cock closed. The flask is removed from the ice, allowed to attain the temperature of the room, and then weighed. The flask is now partially exhausted, transferred to the cooling bath, and after standing the pressure of the residual gas is taken by a manometer. The flask is again brought to room-temperature, and re-weighed. The difference in the weights corresponds to the volume of gas at a pressure equal to the difference of the recorded pressures. The volume of the flask is determined by weighing empty and filled with water. This method has been refined by many experimenters, among whom we may notice Morley and Lord Rayleigh. Morley determined the densities of hydrogen and oxygen in the course of his classical investigation of the composition of water. The method differed from Regnault's inasmuch as the flask was exhausted to an almost complete vacuum, a performance rendered possible by the high efficiency of the modern air-pump. The actual experiment necessitates the most elaborate precautions, for which reference must be made to Morley's original papers in the *Smithsonian Contributions to Knowledge* (1895), or to M. Travers, *The Study of Gases*. Lord Rayleigh has made many investigations of the absolute densities of gases, one of which, namely on atmospheric and artificial nitrogen, undertaken in conjunction with Sir William Ramsay, culminated in the discovery of argon (*q.v.*). He pointed out in 1888 (*Proc. Roy. Soc.* 43, p. 361) an important correction which had been overlooked by previous experimenters with Regnault's method, viz. the change in volume of the experimental globe due to shrinkage under diminished pressure; this may be experimentally determined and amounts to between 0·04 and 0·16 % of the volume of the globe.

Related to the determination of the density of a gas is the determination of the density of a vapour, *i.e.* matter which at ordinary temperatures exists as a solid or liquid. This subject owes its importance in modern chemistry to the fact that the vapour density, when hydrogen is taken as the standard, gives perfectly definite information as to the molecular condition of the compound, since twice the vapour density equals the molecular weight of the compound. Many methods have been devised. In historical order we may briefly enumerate the following:—In 1811, Gay-Lussac volatilized a weighed quantity of liquid, which must be readily volatile, by letting it rise up a short tube containing mercury and standing inverted in a vessel holding the same metal. This method was developed by Hofmann in 1868, who replaced the short tube of Gay-Lussac by an ordinary barometer tube, thus effecting the volatilization in a Torricellian vacuum. In 1826 Dumas devised a method suitable for substances of high boiling-point; this consisted in its essential point in vaporizing the substance in a flask made of suitable material, sealing it when full of vapour, and weighing. This method is very tedious in detail. H. Sainte-Claire Deville and L. Troost made it available for specially high temperatures by employing porcelain vessels, sealing them with the oxyhydrogen blow-pipe, and maintaining a constant temperature by a vapour bath of mercury (350°), sulphur (440°), cadmium (860°) and zinc (1040°). In 1878 Victor Meyer devised his air-expulsion method.

Before discussing the methods now used in detail, a summary of the conclusions reached by Victor Meyer in his classical investigations in this field as to the applicability of the different methods will be given:

(1) For substances which do not boil higher than 260° and have vapours stable for 30° above the boiling-point and which do not react on mercury, use Victor Meyer's "mercury expulsion method."

(2) For substances boiling between 260° and 420°, and which do not react on metals, use Meyer's "Wood's alloy expulsion method."

(3) For substances boiling at higher temperatures, or for any substance which reacts on mercury, Meyer's "air expulsion method" must be used. It is to be noted, however, that this method is applicable to substances of any boiling-point (see below).

(4) For substances which can be vaporized only under diminished pressure, several methods may be used. (*a*) Hofmann's is the best if the substance volatilizes at below 310°, and does not react on mercury; otherwise (*b*) Demuth and Meyer's, Eykman's, Schall's, or other methods may be used.

1. *Meyer's "Mercury Expulsion" Method.*—A small quantity of the substance is weighed into a tube, of the form shown in fig. 4, which has a capacity of about 35 cc., provided with a capillary tube at the top, and a bent tube about 6 mm. in diameter at the bottom. The vessel is completely filled with mercury, the capillary sealed, and the vessel weighed. The vessel is then lowered into a jacket containing vapour at a known temperature which is sufficient to volatilize the substance. Mercury is expelled, and when this expulsion ceases, the vessel is removed, allowed to cool, and weighed. It is necessary to determine the pressure exerted on the vapour by the mercury in the narrow limb; this is effected by opening the capillary and inclining the tube until the mercury just reaches the top of the narrow tube; the difference between the height of the mercury in the wide tube and the top of the narrow tube represents the pressure due to the mercury column, and this must be added to the barometric pressure in order to deduce the total pressure on the vapour.

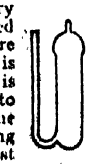

FIG. 4.

The result is calculated by means of the formula:

$$D=\frac{W(1+at)\times 7{,}980{,}000}{(p+p_1-s)[m\{1+\beta(t-t_0)\}-m_1\{1+\gamma(t-t_0)\}](1+\gamma t)},$$

in which W = weight of substance taken; t = temperature of vapour bath; a = 0·00360 = temperature coefficient of gases; p = barometric pressure; p_1 = height of mercury column in vessel; s = vapour tension of mercury at $t°$; m = weight of mercury contained in the vessel; m_1 = weight of mercury left in vessel after heating; β = coefficient of expansion of glass = ·0000303; γ = coefficient of expansion of mercury = 0·00018 (0·00019 above 240°) (see *Ber.* 1877, 10, p. 2068; 1886, 19, p. 1862).

2. *Meyer's Wood's Alloy Expulsion Method.*—This method is a modification of the one just described. The alloy used is composed of 15 parts of bismuth, 8 of lead, 4 of tin and 3 of cadmium; it melts at 70°, and can be experimented with as readily as mercury. The cylindrical vessel is replaced by a globular one, and the pressure on the vapour due to the column of alloy in the side tube is readily reduced to millimetres of mercury since the specific gravity of the alloy at the temperature of boiling sulphur, 444° (at which the apparatus is most frequently used), is two-thirds of that of mercury (see *Ber.* 1876, 9, p. 1220).

3. *Meyer's Air-Expulsion Method.*—The simplicity, moderate accuracy, and adaptability of this method to every class of substance which can be vaporized entitles it to rank as one of the most potent methods in analytical chemistry; its invention is indissolubly connected with the name of Victor Meyer, being termed "Meyer's method" to the exclusion of his other original methods. It consists in determining the air expelled from a vessel by the vapour of a given quantity of the substance. The apparatus is shown in fig. 5. A long tube (*a*) terminates at the bottom in a cylindrical chamber of about 100-150 cc. capacity. The top is fitted with a rubber stopper, or in some forms with a stop-cock, while a little way down there is a bent delivery tube (*b*). To use the apparatus, the long tube is placed in a vapour bath (*c*) of the requisite temperature, and after the air within the tube is in equilibrium, the delivery tube is placed beneath the surface of the water in a pneumatic trough, the rubber stopper pushed home, and observation made as to whether any more air is being expelled. If this be not so, a graduated tube (*d*) is filled with water, and inverted over the delivery tube. The rubber stopper is removed and the experimental substance introduced, and the stopper quickly replaced to the same extent as before. Bubbles are quickly disengaged and collect in the

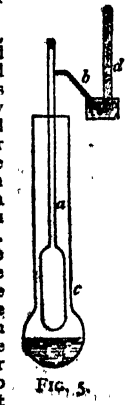

FIG. 5.

graduated tube. Solids may be directly admitted to the tube from a weighing bottle, while liquids are conveniently introduced by means of small stoppered bottles, or, in the case of exceptionally volatile liquids, by means of a bulb blown on a piece of thin capillary tube, the tube being sealed during the weighing operation, and the capillary broken just before transference to the apparatus. To prevent the bottom of the apparatus being knocked out by the impact of the substance, a layer of sand, asbestos or sometimes mercury is placed in the tube. To complete the experiment, the graduated tube containing the expelled air is brought to a constant and determinate temperature and pressure, and thus volume is the volume which the given weight of the substance would occupy if it were a gas under the same temperature and pressure. The vapour density is calculated by the following formula:

$$D=\frac{W(1+at)\times 587.780}{(p-s)V},$$

in which W = weight of substance taken, V = volume of air expelled, $a=1/273=.003665$, t and p = temperature and pressure at which expelled air is measured, and s = vapour pressure of water at $t°$.

By varying the material of the bulb, this apparatus is rendered available for exceptionally high temperatures. Vapour baths of iron are used in connexion with boiling anthracene (335°), anthraquinone (368°), sulphur (444°), phosphorus pentasulphide (518°); molten lead may also be used. For higher temperatures the bulb of the vapour density tube is made of porcelain or platinum, and is heated in a gas furnace.

FIG. 6.

(4a) *Hofmann's Method.*—Both the *modus operandi* and apparatus employed in this method particularly recommend its use for substances which do not react on mercury and which boil in a vacuum at below 310°. The apparatus (fig. 6) consists of a barometer tube, containing mercury and standing in a bath of the same metal, surrounded by a vapour jacket. The vapour is circulated through the jacket, and the height of the mercury read by a cathetometer or otherwise. The substance is weighed into a small stoppered bottle, which is then placed beneath the mouth of the barometer tube. It ascends the tube, the substance is rapidly volatilized, and the mercury column is depressed; this depression is read off. It is necessary to know the volume of the tube above the second level; this may most efficiently be determined by calibrating the tube prior to its use. Sir T. E. Thorpe employed a barometer tube 96 cm. long, and determined the volume from the closed end for a distance of about 35 mm. by weighing in mercury; below this mark it was calibrated in the ordinary way so that a scale reading gave the volume at once. The calculation is effected by the following formulae:—

$$D=\frac{760w(1+0.003665t)}{0.0012934\times V\times B};$$

$$B=\frac{h}{1+0.00018t_1}-\left(\frac{h_1}{1+0.00018t_2}-\frac{h_2}{1+0.00018t}+s\right),$$

in which w = weight of substance taken; t = temperature of vapour jacket; V = volume of vapour at t; h = height of barometer reduced to 0°; t_1 = temperature of air; h_1 = height of mercury column below vapour jacket; t_2 = temperature of mercury column not heated by vapour; h_2 = height of mercury column within vapour jacket; s = vapour tension of mercury at $t°$. The vapour tension of mercury need not be taken into account when water is used in the jacket.

(4b) *Demuth and Meyer's Method.* The principle of this method is as follows: In the ordinary air expulsion method, the vapour always mixes to some extent with the air in the tube, and this involves a reduction of the pressure of the vapour. It is obvious that this reduction may be increased by accelerating the diffusion of the vapour. This may be accomplished by using a vessel with a somewhat wide bottom, and inserting the substance so that it may be volatilized very rapidly, as, for example, in tubes of Wood's alloy, and by filling the tube with hydrogen. (For further details see *Ber.* 23, p. 311.)

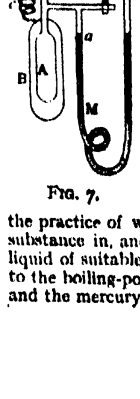

FIG. 7.

We may here notice a modification of Meyer's process in which the increase of pressure due to the volatilization of the substance, and not the volume of the expelled air, is measured. This method has been developed by J. S. Lumsden (*Journ. Chem. Soc.* 1903, 83, p. 342), whose apparatus is shown diagrammatically in fig. 7. The vaporizing bulb A has fused about it a jacket B, provided with a condenser c. Two side tubes are fused on to the neck of A: the lower one leads to a mercury manometer M, and to the air by means of a cock C; the upper tube is provided with a rubber stopper through which a glass rod passes—this rod serves to support the tube containing the substance to be experimented upon, and so avoids the objection to the practice of withdrawing the stopper of the tube, dropping the substance in, and reinserting the stopper. To use the apparatus, a liquid of suitable boiling-point is placed in the jacket and brought to the boiling-point. All parts of the apparatus are open to the air, and the mercury in the manometer is adjusted so as to come to a fixed mark a. The substance is now placed on the support already mentioned, and the apparatus closed to the air by inserting the cork at D and turning the cock C. By turning or withdrawing the support the substance enters the bulb; and during its vaporization the free limb of the manometer is raised so as to maintain the mercury at a. When the volatilization is quite complete, the level is accurately adjusted, and the difference of the levels of the mercury gives the pressure exerted by the vapour. To calculate the result it is necessary to know the capacity of the apparatus to the mark a, and the temperature of the jacket.

Methods depending on the Principles of Hydrostatics.—Hydrostatical principles can be applied to density determinations in four typical ways: (1) depending upon the fact that the heights of liquid columns supported by the same pressure vary inversely as the densities of the liquids; (2) depending upon the fact that a body which sinks in a liquid loses a weight equal to the weight of liquid which it displaces; (3) depending on the fact that a body remains suspended, neither floating nor sinking, in a liquid of exactly the same density; (4) depending on the fact that a floating body is immersed to such an extent that the weight of the fluid displaced equals the weight of the body.

1. The method of balancing columns is of limited use. Two forms are recognized. In one, applicable only to liquids which do not mix, the two liquids are poured into the limbs of a U tube. The heights of the columns above the surface of junction of the liquids are inversely proportional to the densities of the liquids. In the second form, named after Robert Hare (1781–1858), professor of chemistry at the university of Pennsylvania, the liquids are drawn or aspirated up vertical tubes which have their lower ends placed in reservoirs containing the different liquids, and their upper ends connected to a common tube which is in communication with an aspirator for decreasing the pressure within the vertical tubes. The heights to which the liquids rise, measured in each case by the distance between the surfaces in the reservoirs and in the tubes, are inversely proportional to the densities.

2. The method of "hydrostatic weighing" is one of the most important. The principle may be thus stated: the solid is weighed in air, and then in water. If W be the weight in air, and W_1 the weight in water, then W_1 is always less than W, the difference $W-W_1$ representing the weight of the water displaced, *i.e.* the weight of a volume of water equal to that of the solid. Hence $W/(W-W_1)$ is the relative density or specific gravity of the body. The principle is readily adapted to the determination of the relative densities of two liquids, for it is obvious that if W be the weight of a solid body in air, W_1 and W_2 its weights when immersed in the liquids, then $W-W_1$ and $W-W_2$ are the weights of equal volumes of the liquids, and therefore the relative density is the quotient $(W-W_1)/(W-W_2)$. The determination in the case of solids lighter than water is effected by the introduction of a sinker, *i.e.* a body which when affixed to the light solid causes it to sink. If W be the weight of the experimental solid in air, w the weight of the sinker in water, and W_1 the weight of the solid plus sinker in water, then the relative density is given by $W/(W+w-W_1)$. In practice the solid or plummet is suspended from the balance arm by a fibre—silk, platinum, &c.—and carefully weighed. A small stool is then placed over the balance pan, and on this is placed a beaker of distilled water so that the solid is totally immersed. Some balances are provided with a "specific gravity pan," *i.e.* a pan with short suspending arms, provided with a hook at the bottom to which the fibre may be attached; when this is so, the stool is unnecessary. Any air bubbles are removed from the surface of the body by brushing with a camel-hair brush; if the solid be of a porous nature it is desirable to boil it for some time in water, thus expelling the air from its interstices. The weighing is conducted in the usual way by vibrations, except when the weight be small; it is then advisable to bring the pointer to zero, an operation rendered necessary by the damping due to the adhesion of water to the fibre. The temperature and pressure of the air and water must also be taken.

There are several corrections of the formula $\Delta=W/(W-W_1)$ necessary to the accurate expression of the density. Here we can only summarize the points of the investigation. It may be assumed that the weighing is made with brass weights in air at $t°$ and p mm. pressure. To determine the true weight *in vacuo* at 0°, account must be taken of the different buoyancies, or losses of true weight, due to the different volumes of the solids and weights. Similarly in the case of th weighing in water, account must be taken of the buoyancy of the weights, and also, if absolute densities be required, of the density of water at the temperature of the experiment. In a form of great accuracy the absolute density $\Delta(0°/4°)$ is given by

$$\Delta(0°/4°)=(\rho aW-\delta W_1)/(W-W_1),$$

in which W is the weight of the body in air at $t°$ and p mm. pressure, W_1 the weight in water, atmospheric conditions remaining very nearly the same; ρ is the density of the water in which the body is weighed, a is $(1+at°)$ in which a is the coefficient of cubical expansion of the body, and δ is the density of the air at $t°$, p mm. Less accurate formulae are $\Delta=\rho W/(W-W_1)$, the factor involving the density of the air, and the coefficient of the expansion of the solid being disregarded, and $\Delta=W/(W-W_1)$, in which the density of water is taken as unity. Reference may be made to J. Wade and R. W. Merriman, *Journ. Chem. Soc.* 1909, 95, p. 2174.

The determination of the density of a liquid by weighing a plummet in air, and in the standard and experimental liquids, has been put into a very convenient laboratory form by means of the apparatus known as a Westphal balance (fig. 8). It consists of a steel-yard mounted on a fulcrum; one arm carries at its extremity a heavy bob and pointer, the latter moving along a scale affixed to the stand and serving to indicate when the beam is in its standard position. The other arm is graduated in ten divisions and carries riders—bent pieces of wire of determined weights—and at its extremity a hook from which the glass plummet is suspended. To complete the apparatus there is a glass jar which serves to hold the liquid experimented with. The apparatus is so designed that when the plummet is suspended in air, the index of the beam is at the zero of the scale; if this be not so, then it is adjusted by a levelling screw. The plummet is now placed in distilled water at 15°, and the beam brought to equilibrium by means of a rider, which we shall call I, hung on a hook; other riders are provided, $\frac{1}{10}$th and $\frac{1}{100}$th respectively of I. To determine the density of any liquid it is only necessary to suspend the plummet in the liquid, and to bring the beam to its normal position by means of the riders; the relative density is read off directly from the riders.

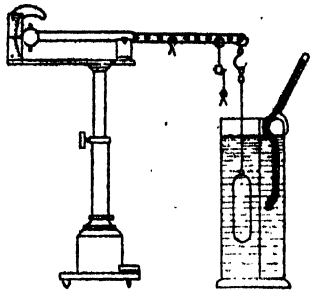

FIG. 8.

3. Methods depending on the free suspension of the solid in a liquid of the same density have been especially studied by Retgers and Gossner in view of their applicability to density determinations of crystals. Two typical forms are in use; in one a liquid is prepared in which the crystal freely swims, the density of the liquid being ascertained by the pycnometer or other methods; in the other a liquid of variable density, the so-called "diffusion column," is prepared, and observation is made of the level at which the particle comes to rest. The first type is in commonest use; since both necessitate the use of dense liquids, a summary of the media of most value, with their essential properties, will be given.

Acetylene tetrabromide, $C_2H_2Br_4$, which is very conveniently prepared by passing acetylene into cooled bromine, has a density of 3·001 at 6° C. It is highly convenient, since it is colourless, odourless, very stable and easily mobile. It may be diluted with benzene or toluene.

Methylene iodide, CH_2I_2, has a density of 3·33, and may be diluted with benzene. Introduced by Brauns in 1886, it was recommended by Retgers. Its advantages rest on its high density and mobility; its main disadvantages are its liability to decomposition, the originally colourless liquid becoming dark owing to the separation of iodine, and its high coefficient of expansion. Its density may be raised to 3·65 by dissolving iodoform and iodine in it.

Thoulet's solution, an aqueous solution of potassium and mercuric iodides (potassium iodo-mercurate), introduced by Thoulet and subsequently investigated by V. Goldschmidt, has a density of 3·196 at 22·9°. It is almost colourless and has a small coefficient of expansion; its hygroscopic properties, its viscous character, and its action on the skin, however, militate against its use. A. Duboin (*Compt. rend.*, 1905, p. 141) has investigated the solutions of mercuric iodide in other alkaline iodides; sodium iodo-mercurate solution has a density of 3·46 at 26°, and gives with an excess of water a dense precipitate of mercuric iodide, which dissolves without decomposition in alcohol; lithium iodo-mercurate solution has a density of 3·28 at 25·6°; and ammonium iodo-mercurate solution a density of 2·98 at 26°.

Rohrbach's solution, an aqueous solution of barium and mercuric iodides, introduced by Carl Rohrbach, has a density of 3·588.

Klein's solution, an aqueous solution of cadmium borotungstate, $2Cd(OH)_2.B_2O_3.9WO_3.16H_2O$, introduced by D. Klein, has a density up to 3·28. The salt melts in its water of crystallization at 75°, and the liquid thus obtained goes up to a density of 3·6.

Silver-thallium nitrate, $TlAg(NO_3)_2$, introduced by Retgers, melts at 75° to form a clear liquid of density 4·8; it may be diluted with water.

The method of using these liquids is in all cases the same; a particle is dropped in; if it floats a diluent is added and the mixture well stirred. This is continued until the particle freely swims, and then the density of the mixture is determined by the ordinary methods (see MINERALOGY).

In the "diffusion column" method, a liquid column uniformly varying in density from about 3·3 to 1 is prepared by pouring a little methylene iodide into a long test tube and adding five times as much benzene. The tube is tightly corked to prevent evaporation, and allowed to stand for some hours. The density of the column at any level is determined by means of the areometrical beads proposed by Alexander Wilson (1714–1786), professor of astronomy at Glasgow University. These are hollow glass beads of variable density; they may be prepared by melting off pieces of very thin capillary tubing, and determining the density in each case by the method just previously described. To use the column, the experimental fragment is introduced, when it takes up a definite position. By successive trials two beads, of known density, say d_1, d_2, are obtained, one of which floats above, and the other below, the test crystal; the distances separating the beads from the crystal are determined by means of a scale placed behind the tube. If the bead of density d_1 be at the distance l_1 above the crystal, and that of d_2 at l_2 below, it is obvious that if the density of the column varies uniformly, then the density of the test crystal is $(d_2l_2+d_1l_1)/(l_1+l_2)$.

Acting on a principle quite different from any previously discussed is the capillary hydrometer or staktometer of Brewster, which is based upon the difference in the surface tension and density of pure water, and of mixtures of alcohol and water in varying proportions.

If a drop of water be allowed to form at the extremity of a fine tube, it will go on increasing until its weight overcomes the surface tension by which it clings to the tube, and then it will fall. Hence any impurity which diminishes the surface tension of the water will diminish the size of the drop (unless the density is proportionately diminished). According to Quincke, the surface tension of pure water in contact with air at 20° C. is 81 dynes per linear centimetre, while that of alcohol is only 25·5 dynes; and a small percentage of alcohol produces much more than a proportional decrease in the surface tension when added to pure water. The capillary hydrometer consists simply of a small pipette with a bulb in the middle of the stem, the pipette terminating in a very fine capillary point. The instrument being filled with distilled water, the number of drops required to empty the bulb and portions of the stem between two marks *m* and *n* (fig. 9) on the latter is carefully counted, and the experiments repeated at different temperatures. The pipette having been carefully dried, the process is repeated with pure alcohol or with proof spirits, and the strength of any admixture of water and spirits is determined from the corresponding number of drops, but the formula generally given is not based upon sound data. Sir David Brewster found with one of these instruments that the number of drops of pure water was 734, while of proof spirit, sp. gr. 920, the number was 2117.

FIG. 9. Brewster's Staktometer.

REFERENCES.—Density and density determinations are discussed in all works on practical physics; reference may be made to B. Stewart and W. W. Haldane Gee, *Practical Physics*, vol. i. (1901); Kohlrausch, *Practical Physics*; Ostwald, *Physico-Chemical Measurements*. The density of gases is treated in M. W. Travers, *The Experimental Study of Gases* (1901); and vapour density determinations in Lassar-Cohn's *Arbeitsmethoden für organisch-chemische Laboratorien* (1901), and *Manual of Organic Chemistry* (1896), and in H. Biltz, *Practical Methods for determining Molecular Weights* (1899). (C. E.*)

DENTATUS, MANIUS CURIUS, Roman general, conqueror of the Samnites and Pyrrhus, king of Epirus, was born of humble parents, and was possibly of Sabine origin. He is said to have been called Dentatus because he was born with his teeth already grown (Pliny, *Nat. Hist.* vii. 15). Except that he was tribune of the people, nothing certain is known of him until his first consulship in 290 B.C. when, in conjunction with his colleague P. Cornelius Rufinus, he gained a decisive victory over the Samnites, which put an end to a war that had lasted fifty years. He also reduced the revolted Sabines to submission; a large portion of their territory was distributed among the Roman citizens, and the most important towns received the citizenship without the right of voting for magistrates (*civitas sine suffragio*). With the proceeds of the spoils of the war Dentatus cut an artificial channel to carry off the waters of Lake Velinus, so as to drain the valley of Reate. In 275, after Pyrrhus had returned from Sicily to Italy, Dentatus (again consul) took the field against him. The decisive engagement took place near Beneventum in the Campi Arusini, and resulted in the total defeat of Pyrrhus. Dentatus celebrated a magnificent triumph, in which for the first time a number of captured elephants were exhibited. Dentatus was consul for the third time in 274, when he finally crushed the Lucanians and Samnites, and censor in 272. In the latter capacity he began to build an aqueduct to carry the waters of the Anio into the city, but died (270) before its completion. Dentatus was looked upon as a model of old Roman simplicity and frugality. According to the well-known anecdote, when the Samnites sent ambassadors with costly presents to induce him to exercise his influence on their behalf in the senate, they found

him sitting on the hearth and preparing his simple meal of roasted turnips. He refused their gifts, saying that earthen dishes were good enough for him, adding that he preferred ruling those who possessed gold to possessing it himself. It is also said that he died so poor that the state was obliged to provide dowries for his daughters. But these and similar anecdotes must be received with caution, and it should be remembered that what was a competence in his day would have been considered poverty by the Romans of later times.

Livy, epitome, 11-14; Polybius ii. 19; Eutropius ii. 9, 14; Florus i. 18; Val. Max. iv. 3, 5, vi. 3, 4; Cicero, *De senectute*, 16; Juvenal xi. 78; Plutarch, *Pyrrhus*, 25.

DENTIL (from Lat. *dens*, a tooth), in architecture, a small tooth-shaped block used as a repeating ornament in the bed-mould of a cornice. Vitruvius (iv. 2) states that the dentil represents the end of a rafter (*asser*); and since it occurs in its most pronounced form in the Ionic temples of Asia Minor, the Lycian tombs and the porticoes and tombs of Persia, where it represents distinctly the reproduction in stone of timber construction, there is but little doubt as to its origin. The earliest example is that found on the tomb of Darius, *c.* 500 B.C., cut in the rock in which the portico of his palace is reproduced. Its first employment in Athens is in the cornice of the caryatid portico or tribune of the Erechtheum (480 B.C.). When subsequently introduced into the bed-mould of the cornice of the choragic monument of Lysicrates it is much smaller in its dimensions. In the later temples of Ionia, as in the temple of Priene, the larger scale of the dentil is still retained. As a general rule the projection of the dentil is equal to its width, and the intervals between to half the width. In some cases the projecting band has never had the sinkings cut into it to divide up the dentils, as in the Pantheon at Rome, and it is then called a dentil-band. The dentil was the chief decorative feature employed in the bed-mould by the Romans and the Italian Revivalists. In the porch of the church of St John Studius at Constantinople, the dentil and the interval between are equal in width, and the interval is splayed back from top to bottom; this is the form it takes in what is known as the "Venetian dentil," which was copied from the Byzantine dentil in Santa Sophia, Constantinople. There, however, it no longer formed part of a bed-mould: its use at Santa Sophia was to decorate the projecting moulding enclosing the encrusted marbles, and the dentils were cut alternately on both sides of the moulding. The Venetian dentil was also introduced as a label round arches and as a string course.

DENTISTRY (from Lat. *dens*, a tooth), a special departure of medical science, embracing the structure, function and therapeutics of the mouth and its contained organs, specifically the teeth, together with their surgical and prosthetic treatment. (For the anatomy of the teeth see TEETH.) As a distinct vocation it is first alluded to by Herodotus (500 B.C.). There are evidences that at an earlier date the Egyptians and Hindus attempted to replace lost teeth by attaching wood or ivory substitutes to adjacent sound teeth by means of threads or wires, but the gold fillings reputed to have been found in the teeth of Egyptian mummies have upon investigation been shown to be superficial applications of gold leaf for ornamental purposes. The impetus given to medical study in the Grecian schools by the followers of Aesculapius and especially Hippocrates (500 to 400 B.C.) developed among the practitioners of medicine and surgery considerable knowledge of dentistry. Galen (A.D. 131) taught that the teeth were true bones existing before birth, and to him is credited the belief that the upper canine teeth receive branches from the nerve which supplies the eye, and hence should be called "eye-teeth." Abulcasis (10th cent. A.D.) describes the operation by which artificial crowns are attached to adjacent sound teeth. Vesalius (1514), Ambroise Paré, J. J. Scaliger, T. Kerckring, M. Malpighi, and lesser anatomists of the same period contributed dissertations which threw some small amount of light upon the structure and functions of the teeth. The operation of transplanting teeth is usually attributed to John Hunter (1728–1793), who practised it extensively, and gave to it additional prominence by transplanting a human tooth to the comb of a cock, but the operation was alluded to by Ambroise Paré (1509–1590), and there is evidence to show that it was practised even earlier. A. von Leeuwenhoek in 1678 described with much accuracy the tubular structure of the dentine, thus making the most important contribution to the subject which had appeared up to that time. Until the latter part of the 18th century extraction was practically the only operation for the cure of toothache.

Historical sketch.

The early contributions of France exerted a controlling influence upon the development of dental practice. Urbain Hémard, surgeon to the cardinal Georges of Armagnac, whom Dr Blake (1801) calls an ingenious surgeon and a great man, published in 1582 his *Researches upon the Anatomy of the Teeth, their Nature and Properties*. Of Hémard, M. Fauchard says: "This surgeon had read Greek and Latin authors, whose writings he has judiciously incorporated in his own works." In 1728 Fauchard, who has been called the father of modern dentistry, published his celebrated work, entitled *Le Chirurgien Dentiste ou traité des dents*. The preface contains the following statement as to the existing status of dental art and science in France, which might have been applied with equal truth to any other European country:—"The most celebrated surgeons having abandoned this branch of surgery, or having but little cultivated it, their negligence gave rise to a class of persons who, without theoretic knowledge or experience, and without being qualified, practised it at hazard, having neither principles nor system. It was only since the year 1700 that the intelligent in Paris opened their eyes to these abuses, when it was provided that those who intended practising dental surgery should submit to an examination by men learned in all the branches of medical science, who should decide upon their merits." After the publication of Fauchard's work the practice of dentistry became more specialized and distinctly separated from medical practice, the best exponents of the art being trained as apprentices by practitioners of ability, who had acquired their training in the same way from their predecessors. Fauchard suggested porcelain as an improvement upon bone and ivory for the manufacture of artificial teeth, a suggestion which he obtained from R. A. F. de Réaumur, the French savant and physicist, who was a contributor to the royal porcelain manufactory at Sévres. Later, Duchateau, an apothecary of St Germain, made porcelain teeth, and communicated his discovery to the Academy of Surgery in 1776, but kept the process secret. Du Bois Chémant carried the art to England, and the process was finally made public by M. Du Bois Foucou. M. Fonzi improved the art to such an extent that the Athenaeum of Arts in Paris awarded him a medal and crown (March 14, 1808).

In Great Britain the 19th century brought the dawning of dental science. The work of Dr Blake in 1801 on the anatomy of the teeth was distinctly in advance of anything previously written on the subject. Joseph Fox was one of the first members of the medical profession to devote himself exclusively to dentistry, and his work is a repository of the best practice of his time. The processes described, though comparatively crude, involve principles in use at the present time. Thomas Bell, the successor of Fox as lecturer on the structure and disease of the teeth at Guy's Hospital, published his well-known work in 1829. About this period numerous publications on dentistry made their appearance, notably those of Koecker, Johnson and Waite, followed somewhat later by the admirable work of Alexander Nasmyth (1839). By this time Cuvier, Serres, Rousseau, Bertin, Herissant and others in France had added to the knowledge of human and comparative dental anatomy, while M. G. Retzius, of Sweden, and E. H. Weber, J. C. Rosenmüller, Schreger, J. E. von Purkinje, B. Fraenkel and J. Müller in Germany were carrying forward the same lines of research. The sympathetic nervous relationships of the teeth with other parts of the body, and the interaction of diseases of the teeth with general pathological conditions, were clearly established. Thus a scientific foundation was laid, and dentistry came to be practised as a specialty of medicine. Certain minor operations, however, such as the extraction of teeth and the stopping of caries in an imperfect way, were still practised by barbers, and the empirical practice of dentistry, especially of

those operations which were almost wholly mechanical, had developed a considerable body of dental artisans who, though without medical education in many cases, possessed a high degree of manipulative skill. Thus there came to be two classes of practitioners, the first regarding dentistry as a specialty of medicine, the latter as a distinct and separate calling.

In America representatives of both classes of dentists began to arrive from England and France about the time of the Revolution. Among these were John Wooffendale (1766), a student of Robert Berdmore of Liverpool, surgeon-dentist to George III.; James Gardette (1778), a French physician and surgeon; and Joseph Lemaire (1781), a French dentist who went out with the army of Count Rochambeau. During the winter of 1781–1782, while the Continental army was in winter quarters at Providence, Rhode Island, Lemaire found time and opportunity to practise his calling, and also to instruct one or two persons, notably Josiah Flagg, probably the first American dentist. Dental practice was thus established upon American soil, where it has produced such fertile results.

Until well into the 19th century apprenticeship afforded the only means of acquiring a knowledge of dentistry. The profits derived from the apprenticeship system fostered secrecy and quackery among many of the early practitioners; but the more liberal minded and better educated of the craft developed an increasing opposition to these narrow methods. In 1837 a local association of dentists was formed in New York, and in 1840 a national association, The American Society of Dental Surgeons, the object of which was "to advance the science by free communication and interchange of sentiments." The first dental periodical in the world, *The American Journal of Dental Science*, was issued in June 1839, and in November 1840 was established the Baltimore College of Dental Surgery, the first college in the world for the systematic education of dentists. Thus the year 1839-1840 marks the birth of the three factors essential to professional growth in dentistry. All this, combined with the refusal of the medical schools to furnish the desired facilities for dental instruction, placed dentistry for the time being upon a footing entirely separate from general medicine. Since then the curriculum of study preparatory to dental practice has been systematically increased both as to its content and length, until in all fundamental principles it is practically equal to that required for the training of medical specialists, and in addition includes the technical subjects peculiar to dentistry. In England, and to some extent upon the continent, the old apprenticeship system is retained as an adjunct to the college course, but it is rapidly dying out, as it has already done in America. Owing to the regulation by law of the educational requirements, the increase of institutions devoted to the professional training of dentists has been rapid in all civilized countries, and during the past twenty years especially so in the United States. Great Britain possesses upwards of twelve institutions for dental instruction, France two, Germany and Switzerland six, all being based upon the conception that dentistry is a department of general medicine. In the United States there were in 1878 twelve dental schools, with about 700 students; in 1907 there were fifty-seven schools, with 6919 students. Of these fifty-seven schools, thirty-seven are departments of universities or of medical institutions, and there is a growing tendency to regard dentistry from its educational aspect as a special department of the general medical and surgical practice.

Course of training.

Recent studies have shown that besides being an important part of the digestive system, the mouth sustains intimate relationship with the general nervous system, and is important as the portal of entrance for the majority of the bacteria that cause specific diseases. This fact has rendered more intimate the relations between dentistry and the general practice of medicine, and has given a powerful impetus to scientific studies in dentistry.

Research.

Through the researches of Sir J. Tomes, Mummery, Hopewell Smith, Williams and others in England, O. Hertwig, Weil and Röse in Germany, Andrews, Sudduth and Black in America, the minute anatomy and embryology of the dental tissues have been worked out with great fulness and precision. In particular, it has been demonstrated that certain general systemic diseases have a distinct oral expression. Through their extensive nervous connexions with the largest of the cranial nerves and with the sympathetic nervous system, the teeth frequently cause irritation resulting in profound reflex nervous phenomena, which are curable only by removal of the local tooth disorder. Gout, lithaemia, scurvy, rickets, lead and mercurial poisoning, and certain forms of chronic nephritis, produce dental and oral lesions which are either pathognomonic or strongly indicative of their several constitutional causes, and are thus of great importance in diagnosis. The most important dental research of modern times is that which was carried out by Professor W. D. Miller of Berlin (1884) upon the cause of caries of the teeth, a disease said to affect the human race more extensively than any other. Miller demonstrated that, as previous observers had suspected, caries is of bacterial origin, and that acids play an important rôle in the process. The disease is brought about by a group of bacteria which develop in the mouth, growing naturally upon the débris of starchy or carbohydrate food, producing fermentation of the mass, with lactic acid as the end product. The lactic acid dissolves the mineral constituent of the tooth structure, calcium phosphate, leaving the organic matrix of the tooth exposed. Another class of germs, the peptonising and putrefactive bacteria, then convert the organic matter into liquid or gaseous end products. The accuracy of the conclusions obtained from his analytic research was synthetically proved, after the manner of Koch, by producing the disease artificially. Caries of the teeth has been shown to bear highly important relation to more remote or systemic diseases. Exposure and death of the dental pulp furnishes an avenue of entrance for disease-producing bacteria, by which invasion of the deeper tissues may readily take place, causing necrosis, tuberculosis, actinomycosis, phlegmon and other destructive inflammations, certain of which, affecting the various sinuses of the head, have been found to cause meningitis, chronic empyema, metastatic abscesses in remote parts of the body, paralysis, epilepsy and insanity.

Operative Dentistry.—The art of dentistry is usually divided arbitrarily into *operative dentistry*, the purpose of which is to preserve as far as possible the teeth and associated tissues, and *prosthetic dentistry*, the purpose of which is to supply the loss of teeth by artificial substitutes. The filling of carious cavities was probably first performed with lead, suggested apparently by an operation recorded by Celsus (100 B.C.), who recommended that frail or decayed teeth be stuffed with lead previous to extraction, in order that they might not break under the forceps. The use of lead as a filling was sufficiently prevalent in France during the 17th century to bring into use the word *plombage*, which is still occasionally applied in that country to the operation of filling. Gold as a filling material came into general use about the beginning of the 19th century.[1] The earlier preparations of gold were so impure as to be virtually without cohesion, so that they were of use only in cavities which had sound walls for its retention. In the form of rolls or tape it was forced into the previously cleaned and prepared cavity, condensed with instruments under heavy hand pressure, smoothed with files, and finally burnished. Tin foil was also used to a limited extent and by the same method. Improvements in the refining of gold for dental use brought the product to a fair degree of purity, and, about 1855, led to the invention by Dr Robert Arthur of Baltimore of a method by which it could be welded firmly within the cavity. The cohesive properties of the foil were developed by passing it through an alcohol flame, which dispelled its surface contaminations. The gold was then welded piece by piece into a homogeneous mass by plugging instruments with serrated points. In this process of cold-welding, the mallet, hitherto in only limited use, was found more efficient than hand pressure, and was rapidly developed. The primitive mallet of wood, ivory, lead or steel, was supplanted by a mallet in which

Fillings or stopping.

[1] The filling of teeth with gold foil is recorded in the oldest known book on dentistry, *Artzney Buchlein*, published anonymously in 1530, in which the operation is quoted from Mesue (A.D. 857), physician to the caliph Haroun al-Raschid.

a hammer was released automatically by a spring condensed by pressure of the operator's hand. Then followed mallets operated by pneumatic pressure, by the dental engine, and finally by the electro-magnet, as utilized in 1867 by Bonwill. These devices greatly facilitated the operation, and made possible a partial or entire restoration of the tooth-crown in conformity with anatomical lines.

The dental engine in its several forms is the outgrowth of the simple drill worked by the hand of the operator. It is used in removing decayed structure and for shaping the cavity for inserting the filling. From time to time its usefulness has been extended, so that it is now used for finishing fillings and polishing them, for polishing the teeth, removing deposits from them and changing their shapes. Its latest development, *the dento-surgical engine*, is of heavier construction and is adapted to operations upon all of the bones, a recent addition to its equipment being the spiral osteotome of Cryer, by which, with a minimum shock to the patient, fenestrae of any size or shape in the brain-case may be made, from a simple trepanning operation to the more extensive openings required in intra-cranial operations. The rotary power may be supplied by the foot of the operator, or by hydraulic or electric motors. The rubber dam invented by S. C. Barnum of New York (1864) provided a means for protecting the field of operations from the oral fluids, and extended the scope of operations even to the entire restoration of tooth-crowns with cohesive gold foil. Its value has been found to be even greater than was at first anticipated. In all operations involving the exposed dental pulp or the pulp-chamber and root-canals, it is the only efficient method of mechanically protecting the field of operation from invasion by disease-producing bacteria.

The difficulty and annoyance attending the insertion of gold, its high thermal conductivity, and its objectionable colour have led to an increasing use of amalgam, guttapercha, and cements of zinc oxide mixed with zinc chloride or phosphoric acid. Recently much attention has been devoted to restorations with porcelain. A piece of platinum foil of ·001 inch thickness is burnished and pressed into the cavity, so that a matrix is produced exactly fitting the cavity. Into this matrix is placed a mixture of powdered porcelain and water or alcohol, of the colour to match the tooth. The mass is carefully dried and then fused until homogeneous. Shrinkage is counteracted by additions of porcelain powder, which are repeatedly fused until the whole exactly fills the matrix. After cooling, the matrix is stripped away and the porcelain is cemented into the cavity. When the cement has hardened, the surface of the porcelain is ground and polished to proper contour. If successfully made, porcelain fillings are scarcely noticeable. Their durability remains to be tested.

Until recent times the exposure of the dental pulp inevitably led to its death and disintegration, and, by invasion of bacteria via the pulp canal, set up an inflammatory process which eventually caused the loss of the entire tooth. A rational system of therapeutics, in conjunction with proper antiseptic measures, has made possible both the conservative treatment of the dental pulp when exposed, and the successful treatment of pulp-canals when the pulp has been devitalized either by design or disease. The conservation of the exposed pulp is affected by the operation of capping. In capping a pulp, irritation is allayed by antiseptic and sedative treatment, and a metallic cap, lined with a non-irritant sedative paste, is applied under aseptic conditions immediately over the point of pulp exposure. A filling of cement is superimposed, and this, after it has hardened, is covered with a metallic or other suitable filling. The utility of arsenious acid for devitalizing the dental pulp was discovered by J. R. Spooner of Montreal, and first published in 1836 by his brother Shearjashub in his *Guide to Sound Teeth*. The painful action of arsenic upon the pulp was avoided by the addition of various sedative drugs,—morphia, atropia, iodoform, &c.,—and its use soon became universal. Of late years it is being gradually supplanted by immediate surgical extirpation under the benumbing effect of cocaine salts. By the use of cocaine also the pain incident to excavating and shaping of cavities in tooth structure may be controlled, especially when the cocaine is driven into the dentine by means of an electric current. To fill the pulp-chamber and canals of teeth after loss of the pulp, all organic remains of pulp tissue should be removed by sterilization, and then, in order to prevent the entrance of bacteria, and consequent infection, the canals should be perfectly filled. Upon the exclusion of infection depends the future integrity and comfort of the tooth. Numberless methods have been invented for the operation. Pulpless teeth are thus preserved through long periods of usefulness, and even those remains of teeth in which the crowns have been lost are rendered comfortable and useful as supports for artificial crowns, and as abutments for assemblages of crowns, known as bridge-work.

Dental therapeutics.

The discoloration of the pulpless tooth through putrefactive changes in its organic matter were first overcome by bleaching it with chlorine. Small quantities of calcium hypochlorite are packed into the pulp-chamber and moistened with dilute acetic acid; the decomposition of the calcium salt liberates chlorine *in situ*, which restores the tooth to normal colour in a short time. The cavity is afterwards washed out, carefully dried, lined with a light-coloured cement and filled. More efficient bleaching agents of recent introduction are hydrogen dioxide in a 25 % solution or a saturated solution of sodium peroxide; they are less irritating and much more convenient in application. Unlike chlorine, these do not form soluble metallic salts which may subsequently discolour the tooth. Hydrogen dioxide may be carried into the tooth structure by the electric current. In which case a current of not less than forty volts controlled by a suitable graduated resistance is applied with the patient in circuit, the anode being a platinum-pointed electrode in contact with the dioxide solution in the tooth cavity, and the cathode a sponge or plate electrode in contact with the hand or arm of the patient. The current is gradually turned on until two or three milliamperes are indicated by a suitable ammeter. The operation requires usually twenty to thirty minutes.

Malposed teeth are not only unsightly but prone to disease, and may be the cause of disease in other teeth, or of the associated tissues. The impairment of function which their abnormal position causes has been found to be the primary cause of disturbances of the general bodily health; for example, enlarged tonsils, chronic pharyngitis and nasal catarrh, indigestion and malnutrition. By the use of springs, screws, vulcanized caoutchouc bands, elastic ligatures, &c., as the case may require, practically all forms of dental irregularity may be corrected, even such protrusions and retrusions of the front teeth as cause great disfigurement of the facial contour.

The extraction of teeth, an operation which until quite recent times was one of the crudest procedures in minor surgery, has been reduced to exactitude by improved instruments, designed with reference to the anatomical relations of the teeth and their alveoli, and therefore adapted to the several classes of teeth. The operation has been rendered painless by the use of anaesthetics. The anaesthetic generally employed is nitrous oxide, or laughing-gas, the use of which was discovered in 1844 by Horace Wells, a dentist of Hartford, Conn., U.S.A. Chloroform and ether, as well as other general anaesthetics, have been employed in extensive operations because of their more prolonged effect; but chloroform, especially, is dangerous, owing to its effect upon the heart, which in many instances has suddenly failed during the operation. Ether, while less manageable than nitrous oxide, has been found to be practically devoid of danger. The local injection of solutions of cocaine and allied anaesthetics into the gum-tissue is extensively practised; but is attended with danger, from the toxic effects of an overdose upon the heart, and the local poisonous effect upon the tissues, which lead in numerous cases to necrosis and extensive sloughing.

Extraction.

Dental Prosthesis.—The fastening of natural teeth or carved substitutes to adjoining sound teeth by means of thread or wire preceded their attachment to base-plates of carved wood, bone or ivory, which latter method was practised until the introduction of swaged metallic plates. Where the crown only of a tooth or those of several teeth were lost, the

Artificial teeth.

restoration was effected by engrafting upon the prepared root a suitable crown by means of a wooden or metallic pivot. When possible, the new crown was that of a corresponding sound tooth taken from the mouth of another individual; otherwise an artificial crown carved from bone or ivory, or sometimes from the tooth of an ox, was used. To replace entire dentures a base-plate of carved hippopotamus ivory was constructed, upon which were mounted the crowns of natural teeth, or later those of porcelain. The manufacture of a denture of this character was tedious and uncertain, and required much skill. The denture was kept in place by spiral springs attached to the buccal sides of the appliance above and below, which caused pressure upon both jaws, necessitating a constant effort upon the part of the unfortunate wearer to keep it in place. Metallic swaged plates were introduced in the latter part of the 18th century. An impression of the gums were taken in wax, from which a cast was made in plaster of Paris. With this as a model, a metallic die of brass or zinc was prepared, upon which the plate of gold or silver was formed, and then swaged into contact with the die by means of a female die or counter-die of lead. The process is essentially the same to-day, with the addition of numerous improvements in detail, which have brought it to a high degree of perfection. The discovery, by Gardette of Philadelphia in 1800, of the utility of atmospheric pressure in keeping artificial dentures in place led to the abandonment of spiral springs. A later device for enhancing the stability is the vacuum chamber, a central depression in the upper surface of the plate, which, when exhausted of air by the wearer, materially increases the adhesion. The metallic base-plate is used also for supporting one or more artificial teeth, being kept in place by metallic clasps fitting to, and partially surrounding, adjacent sound natural teeth, the plate merely covering the edentulous portion of the alveolar ridge. It may also be kept in place by atmospheric adhesion, in which case the palatal vault is included, and the vacuum chamber is utilized in the palatal portion to increase the adhesion.

In the construction usually practised, porcelain teeth are attached to a gold base-plate by means of stay-pieces of gold, perforated to receive the platinum pins baked in the body of the tooth. The stay-pieces or backings are then soldered to the pins and to the plate by means of high-fusing gold solder. The teeth used may be single or in sections, and may be with or without an extension designed in form and colour to imitate the gum of the alveolar border. Even when skilfully executed, the process is imperfect in that the jointing of the teeth to each other, and their adaptation to the base-plate, leaves crevices and recesses, in which food débris and oral secretions accumulate. To obviate these defects the enamelled platinum denture was devised. Porcelain teeth are first attached to a swaged base-plate of pure platinum by a stay-piece of the same metal soldered with pure gold, after which the interstices between the teeth are filled, and the entire surface of the plate, excepting that in contact with the palate and alveolar border, is covered with a porcelain paste called the body, which is modelled to the normal contour of the gums, and baked in a muffle furnace until vitrified. It is then enamelled with a vitreous enamel coloured in imitation of the colour of the natural gum, which is applied and fired as before, the result being the most artistic and hygienic denture known. This is commonly known as the continuous gum method. Originating in France in the early part of the 19th century, and variously improved by several experimenters, it was brought to its present perfection by Dr John Allen of New York about 1846–1847. Dentures supported upon cast bases of metallic alloys and of aluminium have been employed as substitutes for the more expensive dentures of gold and platinum, but have had only a limited use, and are less satisfactory.

Metallic bases were used exclusively as supports for artificial dentures until in 1855–1856 Charles Goodyear, jun., patented in England a process for constructing a denture upon vulcanized caoutchouc as a base. Several modifications followed, each the subject of patented improvements. Though the cheapness and simplicity of the vulcanite base has led to its abuse in incompetent hands, it has on the whole been productive of much benefit. It has been used with great success as a means of attaching porcelain teeth to metallic bases of gold, silver and aluminium. It is extensively used also in correcting irregular positions of the teeth, and for making interdental splints in the treatment of fractures of the jaws. For the mechanical correction of palatal defects causing imperfection of deglutition and speech, which comes distinctly within the province of the prosthetic dentist, the vulcanite base produces the best-known apparatus. Two classes of palatal mechanism are recognized—the obturator, a palatal plate, the function of which is to close perforations or clefts in the hard palate, and the artificial velum, a movable attachment to the obturator or palatal plate, which closes the opening in the divided natural velum and, moving with it, enables the wearer to close off the nasopharynx from the oral cavity in the production of the guttural sounds. Vulcanite is also used for extensive restorations of the jaws after surgical operations or loss by disease, and in the majority of instances wholly corrects the deformity.

For a time vulcanite almost supplanted gold and silver as a base for artificial denture, and developed a generation of practitioners deficient in that high degree of skill necessary to the construction of dentures upon metallic bases.

Modern methods.

The recent development of crown-and-bridge work has brought about a renaissance, so that a thorough training is more than ever necessary to successful practice in mechanical dentistry. The simplest crown is of porcelain, and is engrafted upon a sound natural tooth-root by means of a metallic pin of gold or platinum, extending into the previously enlarged root-canal and cemented in place. In another type of crown the point between the root-end and the abutting crown-surface is encircled with a metallic collar or band, which gives additional security to the attachment and protects the joints from fluids or bacteria. Crowns of this character are constructed with a porcelain facing attached by a stay-piece or backing of gold to a plate and collar, which has been previously fitted to the root-end like a ferrule, and soldered to a pin which projects through the ferrule into the root-canal. The contour of the lingual surface of the crown is made of gold, which is shaped to conform to the anatomical lines of the tooth. The shell-crown consists of a reproduction of the crown entirely of gold plate, filled with cement, and driven over the root-end, which it closely encircles. The two latter kinds of crowns may be used as abutments for the support of intervening crowns in constructing bridge-work. When artificial crowns are supported not by natural tooth-roots but by soldering them to abutments, they are termed dummies. The number of dummies which may be supported upon a given number of roots depends upon the position and character of the abutments, the character of the alveolar tissues, the age, sex and health of the patient, the character of the occlusion or bite, and the force exerted in mastication. In some cases a root will not properly support more than one additional crown; in others an entire bridge denture has been successfully supported upon four well-placed roots. Two general classes of bridge-work are recognized, namely, the fixed and the removable. Removable bridge-work, though more difficult to construct, is preferable, as it can be more thoroughly and easily cleansed. When properly made and applied to judiciously selected cases, the bridge denture is the most artistic and functionally perfect restoration of prosthetic dentistry.

The entire development of modern dentistry dates from the 19th century, and mainly from its latter half. Beginning with a few practitioners and no organized professional basis, educational system or literature, its practitioners are to be found in all civilized communities, those in Great Britain numbering about 5000; in the United States, 27,000; France, 1600, of whom 376 are graduates; German Empire, qualified practitioners (*Zahnärzte*), 1400; practitioners without official qualification, 4100. Its educational institutions are numerous and well equipped. It possesses a large periodical and standard literature in all languages. Its practice is regulated by legislative enactment in all countries the same as is medical practice. The business of manufacturing and selling dentists' supplies

represents an enormous industry, in which millions of capital are invested.

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DENTON, an urban district in the Gorton parliamentary division of Lancashire, England, 4½ m. N.E. from Stockport, on the London & North-Western railway. Pop. (1901) 14,934. In the township are reservoirs for the water supply of Manchester, with a capacity of 1,860,000,000 gallons. The manufacture of felt hats is the leading industry. Coal is extensively mined in the district.

DENVER, the capital of Colorado, U.S.A., the county-seat of Denver county, and the largest city between Kansas City, Missouri, and the Pacific coast, sometimes called the "Queen City of the Plains." Pop. (1870) 4759; (1880) 35,629; (1890) 106,713; (1900), 133,859, of whom 25,301 were foreign-born and 3923 were negroes; (census, 1910) 213,381. Of the 25,301 foreign-born in 1900, 5114 were Germans; 3485, Irish; 3376, Swedes; 3344, English; 2623, English-Canadian; 1338, Russians; and 1033, Scots. Denver is an important railway centre, being served by nine railways, of which the chief are the Atchison, Topeka & Santa Fé; the Chicago, Burlington & Quincy; the Chicago, Rock Island & Pacific; the Denver & Rio Grande; the Union Pacific; and the Denver, North-Western & Pacific, building in 1906.

Denver lies on the South Platte river, at an altitude exactly 1 m. above the sea, about 15 m. from the E. base of the Rocky mountains, which stretch along the W. horizon from N. to S. in an unbroken chain of some 175 m. Excursions may be made in all directions into the mountains, affording beautiful scenery and interesting views of the mining camps. Various peaks are readily accessible from Denver: Long's Peak (14,271 ft.), Gray's Peak (14,341 ft.), Torrey Peak (14,336 ft.), Mt. Evans (14,330 ft.), Pike's Peak (14,108 ft.), and many others of only slightly less altitudes. The streets are excellent, broad and regular. The parks are a fine feature of the city; by its charter a fixed percentage of all expenditures for public improvements must be used to purchase park land. Architectural variety and solidity are favoured in the buildings of the city by a wealth of beautiful building stones of varied colours (limestones, sandstones, lavas, granites and marbles), in addition to which bricks and Roman tiles are employed. The State Capitol, built of native granite and marble (1887–1895, cost $2,500,000), is an imposing building. Noteworthy also are the Denver county court house; the handsome East Denver high school; the Federal building, containing the United States custom house and post office; the United States mint; the large Auditorium, in which the Democratic National convention met in 1908; a Carnegie library (1908) and the Mining Exchange; and there are various excellent business blocks, theatres, clubs and churches. Denver has an art museum and a zoological museum. The libraries of the city contain an aggregate of some 300,000 volumes. Denver is the seat of the Jesuit college of the Sacred Heart (1888; in the suburbs); and the university of Denver (Methodist, 1889), a co-educational institution, succeeding the Colorado Seminary (founded in 1864 by John Evans), and consisting of a college of liberal arts, a graduate school, Chamberlin astronomical observatory and a preparatory school—these have buildings in University Park—and (near the centre of the city) the Denver and Gross College of Medicine, the Denver law school, a college of music in the building of the old Colorado Seminary, and a Saturday college (with classes specially for professional men).

The prosperity of the city depends on that of the rich mining country about it, on a very extensive wholesale trade, for which its situation and railway facilities admirably fit it, and on its large manufacturing and farming interests. The value of manufactures produced in 1900 was $41,368,698 (increase 1890–1900, 41·5 %). The value of the factory product for 1905, however, was 3·3 % less than that for 1900, though it represented 36·6 % of the product of the state as a whole. The principal industry is the smelting and refining of lead, and the smelting works are among the most interesting sights of the city. The value of the ore reduced annually is about $10,000,000. Denver has also large foundries and machine shops, flour and grist mills, and slaughtering and meat-packing establishments. Denver is the central live-stock market of the Rocky Mountain states. The beet sugar, fruit and other agricultural products of the surrounding and tributary section were valued in 1906 at about $20,000,000. The assessed valuation of property in the city in 1905 was $115,338,920 (about the true value), and the bonded debt $1,079,595.

At Denver the South Platte is joined by Cherry Creek, and here in October 1858 were established on opposite sides of the creek two bitterly rival settlements, St Charles and Auraria; the former was renamed almost immediately Denver, after General J. W. Denver (1818–1892), ex-governor of Kansas (which then included Colorado), and Auraria was absorbed. Denver had already been incorporated by a provisional local (extra legal) "legislature," and the Kansas legislature gave a charter to a rival company which the Denver people bought out. A city government was organized in December 1859; and continued under a reincorporation effected by the first territorial legislature of 1861. This body adjourned from Colorado City, nominally the capital, to Denver, and in 1862 Golden was made the seat of government. In 1868 Denver became the capital, but feeling in the southern counties was then so strong against Denver that provision was made for a popular vote on the situation of the capital five years after Colorado should become a state. This popular vote confirmed Denver in 1881. Until 1870, when it secured a branch railway from the Union Pacific line at Cheyenne (Wyoming), the city was on one side of the transcontinental travel-routes. The first road was quickly followed by the Kansas Pacific from Kansas City (1870, now also part of the Union Pacific), the Denver & Rio Grande (1871), the Burlington system (1882), the Atchison, Topeka & Santa Fé (1887), and other roads which have made Denver's fortune. In April 1859 appeared the first number of *The Rocky Mountain News*. The same year a postal express to Leavenworth, Kansas (10 days, letters 25 cents an ounce) was established; and telegraph connexion with Boston and New York ($9 for 10 words) in 1863. A private mint was established in 1860. In the 'seventies all the facilities of a modern city—gas, street-cars, water-works, telephones—were introduced. Much the same might be said of a score of cities in the new West, but none is a more striking example than Denver of marvellous growth. The city throve on the freighting trade of the mines. In 1864 a tremendous flood almost ruined it, and another flood in 1878, and a famous strike in Denver and Leadville in 1879–1880 were further, but only momentary, checks to its prosperity. As in every western city, particularly those in mining regions whose sites attained speculative values, Denver had grave problems with "squatters" or "land-jumpers" in her early years; and there was the usual gambling and outlawry, sometimes extra-legally repressed by vigilantes. Settled social conditions, however, soon established themselves. In 1880 there was a memorable election riot under the guise of an anti-Chinese demonstration. In the decade 1870-1880 the population increased 648·7 %. The 'eighties were notable for great real estate activity, and the population of the city increased 199·5 % from 1880 to 1890. In 1882–1884 three successive annual exhibits of a National Mining and Industrial Exposition were held. After 1890 growth was slower but continuous. In 1902 a city-and-county of Denver was created with extensive powers of framing its own charter, and in 1904 a charter was adopted. The constitution of the state was

framed by a convention that sat at Denver from December 1875 to March 1876; various territorial conventions met here; and here W. J. Bryan was nominated in 1908 for the presidency.

DEODAND (Lat. *Deo dandum*, that which is to be given to God), in English law, was a personal chattel (any animal or thing) which, on account of its having caused the death of a human being, was forfeited to the king for pious uses. Blackstone, while tracing in the custom an expiatory design, alludes to analogous Jewish and Greek laws,[1] which required that what occasions a man's death should be destroyed. In such usages the notion of the punishment of an animal or thing, or of its being morally affected from having caused the death of a man, seems to be implied. The forfeiture of the offending instrument in no way depends on the guilt of the owner. This imputation of guilt to inanimate objects or to the lower animals is not inconsistent with what we know of the ideas of uncivilized races. In English law, deodands came to be regarded as mere forfeitures to the king, and the rules on which they depended were not easily explained by any key in the possession of the old commentators. The law distinguished, for instance, between a thing in motion and a thing standing still. If a horse or other animal in motion killed a person, whether infant or adult, or if a cart ran over him, it was forfeited as a deodand. On the other hand, if death were caused by falling from a cart or a horse at rest, the law made the chattel a deodand if the person killed were an adult, but not if he were below the years of discretion. Blackstone accounts for the greater severity against things in motion by saying that in such cases the owner is more usually at fault, an explanation which is doubtful in point of fact, and would certainly not account for other instances of the same tendency. Thus, where a man's death is caused by a thing not in motion, that part only which is the immediate cause is forfeited, as "if a man be climbing up the wheel of a cart, and is killed by falling from it, the wheel alone is a deodand"; whereas, if the cart were in motion, not only the wheel but all that moves along with it (as the cart and the loading) are forfeited. A similar distinction is to be found in Britton. Where a man is killed by a vessel at rest the cargo is not deodand; where the vessel is under sail, hull and cargo are both deodand. For the distinction between the death of a child and the death of an adult Blackstone accounts by suggesting that the child "was presumed incapable of actual sin, and therefore needed no deodand to purchase propitiatory masses; but every adult who died in actual sin stood in need of such atonement, according to the humane superstition of the founders of the English law." Sir Matthew Hale's explanation was that the child could not take care of himself, whereon Blackstone asks why the owner should save his forfeiture on account of the imbecility of the child, which ought to have been an additional reason for caution. The finding of a jury was necessary to constitute a deodand, and the investigation of the value of the instrument by which death was caused occupied an important place among the provisions of early English criminal law. It became a necessary part of an indictment to state the nature and value of the weapon employed—as, that the stroke was given by a certain penknife, of the value of sixpence—so that the king might have his deodand. Accidents on the high seas did not cause forfeiture, being beyond the domain of the common law; but it would appear that in the case of ships in fresh water the law held good. The king might grant his right to deodands to another. In later times these forfeitures became extremely unpopular; and juries, with the connivance of judges, found deodands of trifling value, so as to defeat the inequitable claim. At last, by an act of 1846 they were abolished, the date noticeably coinciding with the introduction of railways and modern steam-engines.

DEOGARH, the name of several towns of British India. (1) A town in the Santal Parganas district of Bengal. Pop. (1901) 8338. It is famous for a group of twenty-two temples dedicated to Siva, the resort of numerous pilgrims. It is connected with the East Indian railway by a steam tramway, 5 m. in length. (2) The headquarters of the Bamra feudatory state in Bengal; 58 m. by road from the Bamra Road station on the Bengal-Nagpur railway. Pop. (1901) 5702. The town, which is well laid out, with parks and gardens, and pleasantly situated in a hollow among hills, rapidly increased in population under the enlightened administration of the raja, Sir Sudhal Rao, K.C.I.E. (b. 1860). It has a state-supported high school affiliated to Calcutta University, with a chemical and physical laboratory. (3) The chief town of the Deogarh estate in the state of Udaipur, Rajputana, about 68 m. N.N.E. of the city of Udaipur. It is walled, and contains a fine palace. Pop. (1901) 5384. The holder of the estate is styled *rawat*, and is one of the first-class nobles of Mewar. (4) Deogarh Fort, the ancient Devagiri or Deogiri (see DAULATABAD).

DÉOLS, a suburb of the French town of Châteauroux, in the department of Indre. Pop. (1906) 2337. Déols lies to the north of Châteauroux, from which it is separated by the Indre. It preserves a fine Romanesque tower and other remains of the church of a famous Benedictine abbey, the most important in Berry, founded in 917 by Ebbes the Noble, lord of Déols. A gateway flanked by towers survives from the old ramparts of the town. The parish church of St Stephen (15th and 16th centuries) has a Romanesque façade and a crypt containing the ancient Christian tomb of St Ludre and his father St Leocade, who according to tradition were lords of the town in the 4th century. There are also interesting old paintings of the 16th century representing the ancient abbey. The pilgrimage to the tomb of St Ludre gave importance to Déols, which under the name of *Vicus Dolensis* was in existence in the Roman period. In 468 the Visigoths defeated the Gauls there, the victory carrying with it the supremacy over the district of Berry. In the middle ages the head of the family of Déols enjoyed the title of prince and held sway over nearly all Lower Berry, of which the town itself was the capital. In the 10th century Raoul of Déols gave his castle to the monks of the abbey and transferred his residence to Châteauroux. For centuries this change did not affect the prosperity of the place, which was maintained by the prestige of its abbey. But the burning of the abbey church by the Protestants during the religious wars and in 1622 the suppression of the abbey by the agency of Henry II., prince of Condé and of Déols, owing to the corruption of the monks, led to its decadence.

DEPARTMENT (Fr. *département*, from *départir*, to separate into parts), a division. The word is used of the branches of the administration in a state or municipality; in Great Britain it is applied to the subordinate divisions only of the great offices and boards of state, such as the bankruptcy department of the Board of Trade, but in the United States these subordinate divisions are known as "bureaus," while "department" is used of the eight chief branches of the executive.

A particular use of the word is that for a territorial division of France, corresponding loosely to an English county. Previous to the French Revolution, the local unit in France was the province, but this division was too closely bound up with the administrative mismanagement of the old régime. Accordingly, at the suggestion of Mirabeau, France was redivided on entirely new lines, the thirty-four provinces being broken up into eighty-three departments (see FRENCH REVOLUTION). The idea was to render them as nearly as possible equal to a certain average of size and population, though this was not always adhered to. They derived their names principally from rivers, mountains or other prominent geographical features. Under Napoleon the number was increased to one hundred and thirty, but in 1815 it was reduced to eighty-six. In 1860 three new departments were created out of the newly annexed territory of Savoy and Nice. In 1871 three departments (Bas-Rhin, Haut-Rhin and Moselle) were lost after the German war. Of the remains of the Haut-Rhin was formed the territory of Belfort, and the fragments of the Moselle were incorporated in the department of Meurthe, which was renamed Meurthe-et-Moselle, making the number at present eighty-seven. For a complete list of the departments see FRANCE. Each department is presided over by an officer called a prefect, appointed by the government, and assisted by a

[1] Compare also the rule of the Twelve Tables, by which an animal which had inflicted mischief might be surrendered in lieu of compensation.

prefectorial council (*conseil de préfecture*). The departments are subdivided into arrondissements, each in charge of a sub-prefect. Arrondissements are again subdivided into cantons, and these into communes, somewhat equivalent to the English parish (see FRANCE: *Local Government*).

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Earlier British Transportation System.—At a time when the British statute-book bristled with capital felonies, when the pick-pocket or sheep-stealer was hanged out of hand, when Sir Samuel Romilly, to whose strenuous exertions the amelioration of the penal code is in a great measure due, declared that the laws of England were written in blood, another and less sanguinary penalty came into great favour. The deportation of criminals beyond the seas grew naturally out of the laws which prescribed banishment for certain offences. The Vagrancy Act of Elizabeth's reign contained in it the germ of transportation, by empowering justices in quarter sessions to banish offenders and order them to be conveyed into such parts beyond the seas as should be assigned by the privy council. Full effect was given to this statute in the next reign, as is proved by a letter of James I. dated 1619, in which the king directs "a hundred dissolute persons" to be sent to Virginia. Another act of similar tenor was passed in the reign of Charles II., in which the term "transportation" appears to have been first used. A further and more systematic development of the system of transportation took place in 1617, when an act was passed by which offenders who had escaped the death penalty were handed over to contractors, who engaged to transport them to the American colonies. These contractors were vested with a property in the labour of the convicts for a certain term, generally from seven to fourteen years, and this right they frequently sold. Labour in those early days was scarce in the new settlements; and before the general adoption of negro slavery there was a keen competition for felon hands. An organized system of kidnapping prevailed along the British coasts; young lads were seized and sold into what was practically white slavery in the American plantations. These malpractices were checked, but the legitimate traffic in convict labour continued, until it was ended peremptorily by the revolt of the American colonies and the achievement of their independence in 1776.[1]

American plantations.

The British legislature, making a virtue of necessity, discovered that transportation to the colonies was bound to be attended by various inconveniences, particularly by depriving the kingdom of many subjects whose labour might be useful to the community; and an act was accordingly passed which provides that convicts sentenced to transportation might be employed at hard labour at home. At the same time the consideration of some scheme for their disposal was entrusted to three eminent public men—Sir William Blackstone, Mr Eden (afterwards Lord Auckland) and John Howard. The result of their labours was an act for the establishment of penitentiary houses, dated 1778. This act is of peculiar importance. It contains the first public enunciation of a general principle of prison treatment, and shows that even at that early date the system since nearly universally adopted was fully understood. The object in view was thus stated. It was hoped "by sobriety, cleanliness and medical assistance, by a regular series of labour, by solitary confinement during the intervals of work and by due religious instruction to preserve and amend

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the health of the unhappy offenders, to inure them to habits of industry, to guard them from pernicious company, to accustom them to serious reflection and to teach them both the principles and practice of every Christian and moral duty." The experience of succeeding years has added little to these the true principles of penal discipline; they form the basis of every species of prison system carried out since the passing of an act of 1779.

No immediate action was taken by the committee appointed. Its members were not in accord as to the choice of site. One was for Islington, another for Limehouse; Howard only stipulated for some healthy place well supplied with water and conveniently situated for supervision. He was strongly of opinion that the penitentiary should be built by convict labour. Howard withdrew from the commission, and new members were appointed, who were on the eve of beginning the first penitentiary when the discoveries of Captain Cook in the South Seas turned the attention of the government towards these new lands. The vast territories of Australasia promised an unlimited field for convict colonization, and for the moment the scheme for penitentiary houses fell to the ground. Public opinion generally preferred the idea of establishing penal settlements at a distance from home. "There was general confidence," says Merivale in his work on colonization, "in the favourite theory that the best mode of punishing offenders was that which removed them from the scene of offence and temptation, cut them off by a great gulf of space from all their former connexions, and gave them the opportunity of redeeming past crimes by becoming useful members of society." These views so far prevailed that an expedition consisting of nine transports and two men-of-war, the "first fleet" of Australian annals, sailed in March 1787 for New South Wales. This first fleet reached Botany Bay in January 1788, but passed on and landed at Port Jackson, where it entered and occupied Sydney harbour. From that time forward convicts were sent in constantly increasing numbers from England to the Antipodes. Yet the early settlement at Sydney had not greatly prospered. The infant colony had had a bitter struggle for existence. It had been hoped that the community would raise its own produce and speedily become self-supporting. But the soil was unfruitful; the convicts knew nothing of farming. All lived upon rations sent out from home; and when convoys with relief lingered by the way famine stared all in the face. The colony was long a penal settlement and nothing more, peopled only by two classes, convicts and their masters; criminal bondsmen on the one hand who had forfeited their independence and were bound to labour without wages for the state, on the other officials to guard and exact the due performance of tasks. A few free families were encouraged to emigrate, but they were lost in the mass they were intended to leaven, swamped and outnumbered by the convicts, shiploads of whom continued to pour in year after year. When the influx increased, difficulties as to their employment arose. Free settlers were too few to give work to more than a small proportion. Moreover, a new policy was in the ascendant, initiated by Governor Macquarie, who considered the convicts and their rehabilitation his chief care, and steadily discouraged the immigration of any but those who "came out for their country's good." The great bulk of the convict labour thus remained in government hands.

Australian penal settlements.

This period marked the first phase in the history of transportation. The penal colony, having triumphed over early dangers and difficulties, was crowded with convicts in a state of semi-freedom, maintained at the public expense and utilized in the development of the latent resources of the country. The methods employed by Governor Macquarie were not, perhaps, invariably the best; the time was hardly ripe as yet for the erection of palatial buildings in Sydney, while the congregation of the workmen in large bodies tended greatly to their demoralization. But some of the works undertaken and carried out were of incalculable service to the young colony; and its early advance in wealth and prosperity was greatly due to the magnificent roads, bridges and other facilities of inter-communication for which it was indebted to Governor Macquarie. As time passed the criminal sewage flowing from the Old World to the New greatly increased in volume under milder and more humane laws. Many now escaped the gallows, and much of the overcrowding of the gaols at home was caused by the gangs of convicts awaiting transhipment to the Antipodes. They were packed off, however, with all convenient despatch, and the numbers on government hands in the colonies multiplied exceedingly, causing increasing embarrassment as to their disposal. Moreover, the expense of the Australian convict establishments was enormous.

Some change in system was inevitable, and the plan of "assignment" was introduced; in other words, that of freely lending the convicts to any who would relieve the authorities of the burdensome charge. By this time free settlers were arriving in greater number, invited by a different and more liberal policy than that of Governor Macquarie. Inducements were especially offered to persons possessed of capital to assist in the development of the country. Assignment developed rapidly; soon eager competition arose for the convict hands that had been at first so reluctantly taken. Great facilities existed for utilizing them on the wide areas of grazing land and on the new stations in the interior. A pastoral life, without temptations and contaminating influences, was well suited for convicts. As the colony grew richer and more populous, other than agricultural employers became assignees, and numerous enterprises were set on foot. The trades and callings which minister to the needs of all civilized communities were more and more largely pursued. There was plenty of work for skilled convicts in the towns, and the services of the more intelligent were highly prized. It was a great boon to secure gratis the assistance of men specially trained as clerks, book-keepers or handicraftsmen. Hence all manner of intrigues and manœuvres were afoot on the arrival of drafts and there was a scramble for the best hands. Here at once was a palpable flaw in the system of assignment. The lot of the convict was altogether unequal. Some, the dull, unlettered and unskilled, were drafted up country to heavy manual labour at which they remained, while clever expert rogues found pleasant, congenial and often profitable employment in the towns. The contrast was very marked from the first, but it became the more apparent when in due course it was seen that some were still engaged in irksome toil, while others who had come out by the same ship had already attained to affluence and ease. For the latter transportation was no punishment, but often the reverse. It meant too often transfer to a new world under conditions more favourable to success, removed from the keener competition of the old. By adroit management, too, convicts often obtained the command of funds, the product of nefarious transactions at home, which wives or near relatives or unconvicted accomplices presently brought out to them. It was easy for the free new-comers to secure the assignment of their convict friends; and the latter, although still nominally servants and in the background, at once assumed the real control. Another system productive of much evil was the employment of convict clerks in positions of trust in various government offices; convicts did much of the legal work of the colony; a convict was clerk to the attorney general; others were schoolmasters and were entrusted with the education of youth.

Assignment system.

Under a system so anomalous and uncertain the main object of transportation as a method of penal discipline and repression was in danger of being quite overlooked. Yet the state could not entirely abdicate its functions, although it surrendered to a great extent the care of criminals to private persons. It had established a code of penalties for the coercion of the ill-conducted, while it kept the worst perforce in its own hands. The master was always at liberty to appeal to the strong arm of the law. A message carried to a neighbouring magistrate, often by the culprit himself, brought down the prompt retribution of the lash. Convicts might be flogged for petty offences, for idleness, drunkenness, turbulence, absconding and so forth. At the out-stations some show of decorum and regularity was observed, although the work done was generally scanty and the convicts were secretly given to all manner of evil courses. The town convicts were worse, because they were far less controlled. They were nominally under the

Evils of convict system.

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American plantations.

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movement towards prison reform, could offer but limited accommodation. A proposal was put forward to construct convict barracks in the vicinity of the great arsenals; but this, which contained really the germ of the present British penal system, was premature. The government in this dilemma steered a middle course and resolved to adhere to transportation, but under a greatly modified and it was hoped much improved form. The colony of Van Diemen's Land, younger and less self-reliant than its neighbour, had also endured convict immigration but had made no protest. It was resolved to direct the whole stream of deportation upon Van Diemen's Land, which was thus constituted one vast colonial prison. The main principle of the new system was one of probation; hence its name. All convicts were to pass through various stages and degrees of punishment according to their conduct and character. Some general depot was needed where the necessary observation could be made, and it was found at Millbank penitentiary. Thence boys were sent to the prison for juveniles at Parkhurst; the most promising subjects among the adults were selected to undergo the experimental discipline of solitude and separation at Pentonville; less hopeful cases went to the hulks; and all adults alike passed on to the Antipodes. Fresh stages awaited the convict on his arrival at Van Diemen's Land. The first was limited to "lifers" and colonial convicts sentenced a second time. It consisted in detention at one of the penal stations, either Norfolk Island or Tasman's Peninsula, where the disgraceful conditions already described continued unchanged to the very last. The second stage received the largest number, who were subjected in it to gang labour, working under restraint in various parts of the colony. These probation stations, as they were called, were intended to inculcate habits of industry and subordination; they were provided with supervisors and religious instructors; and had they not been tainted by the vicious virus brought to them by others arriving from the penal stations, they might have answered their purpose for a time. But they became as bad as the worst of the penal settlements and contributed greatly to the breakdown of the whole system. The third stage and the first step towards freedom was the concession of a pass which permitted the convict to be at large under certain conditions to seek work for himself; the fourth was a ticket-of-leave, the possession of which allowed him to come and go much as he pleased; the fifth and last was absolute pardon, with the prospects of rehabilitation.

This scheme seemed admirable on paper; yet it failed completely when put into practice. Colonial resources were quite unable to bear the pressure. Within two or three years Van Diemen's Land was inundated with convicts. Sixteen thousand were sent out in four years; the average annual number in the colony was about 30,000, and this when there was only 37,000 free settlers. Half the whole number of convicts remained in government hands and were kept in the probation gangs, engaged upon public works of great utility; but the other half, pass-holders and ticket-of-leave men in a state of semi-freedom, could get little or no employment. The supply greatly exceeded the demand; there were no hirers of labour. Had the colony been as large and as prosperous as its neighbour it could scarcely have absorbed the glut of workmen; but it was really on the verge of bankruptcy—its finances were embarrassed, its trades and industries at a standstill. But not only were the convicts idle; they were utterly depraved. It was soon found that the system which kept large bodies always together had a most pernicious effect upon their moral condition. "The congregation of criminals in large batches without adequate supervision meant simply wholesale, widespread pollution," as was said at the time. These ever-present and constantly increasing evils forced the government to reconsider its position; and in 1846 transportation to Van Diemen's Land was temporarily suspended for a couple of years, during which it was hoped some relief might be afforded. The formation of a new convict colony in North Australia had been contemplated; but the project, warmly espoused by Mr Gladstone, then under-secretary of state for the colonies, was presently abandoned; and it now became clear that no resumption of transportation was possible. The measures taken to substitute other methods of secondary punishment are set forth in the article PRISON (*q.v.*).

Gradual abandonment.

France.—France adopted deportation for criminals as far back as 1763, when a penal colony was founded in French Guiana and failed disastrously. An expedition was sent there, composed of the most evil elements of the Paris population and numbering 14,000, all of whom died. The attempt was repeated in 1766 and with the same miserable result. Other failures are recorded, the worst being the scheme of the philanthropist Baron Milius, who in 1823 planned to form a community on the banks of the Mana (French Guiana) by the marriage of exiled convicts and degraded women, which resulted in the most ghastly horrors. The principle of deportation was then formally condemned by publicists and government until suddenly in 1854 it was reintroduced into the French penal code with many high-sounding phrases. Splendid results were to be achieved in the creation of rich colonies afar, and the regeneration of the criminal by new openings in a new land. The only outlet available at the moment beyond the sea was French Guiana, and it was again to be utilized despite its pestilential climate. Thousands were exiled, more than half to find certain death; none of the penal settlements prospered. No return was made by agricultural development, farms and plantations proved a dead loss under the unfavourable conditions of labour enforced in a malarious climate and unkindly soil, and it was acknowledged by French officials that the attempt to establish a penal colony on the equator was utterly futile. Deportation to Guiana was not abandoned, but instead of native-born French exiles, convicts of subject races, Arabs, Anamites and Asiatic blacks, were sent exclusively, with no better success as regards colonization.

French practice.

In 1864, however, it was possible to divert the stream elsewhere. New Caledonia in the Australian Pacific was annexed to France in 1853. Ten years later it became a new settlement for convict emigrants. A first shipload was disembarked in 1864 at Noumea, and the foundations of the city laid. Prison buildings were the first erected and were planted upon the island of Nou, a small breakwater to the Bay of Noumea. Outwardly all went well under the fostering care of the authorities. The population steadily increased; an average total of 600 in 1867 rose in the following year to 1554. In 1874 the convict population exceeded 5000; in 1880 it had risen to 8000; the total reached 9608 at the end of December 1883. But from that time forward the numbers transported annually fell, for it was found that this South Pacific island, with its fertile soil and fairly temperate climate, by no means intimidated the dangerous classes; and the French administration therefore resumed deportation of French-born whites to Guiana, which was known as notoriously unhealthy and was likely to act as a more positive deterrent. The authorities divided their exiles between the two outlets, choosing New Caledonia for the convicts who gave some promise of regeneration, and sending criminals with the worst antecedents and presumably incorrigible to the settlements on the equator. This was in effect to hand over a fertile colony entirely to criminals. Free immigration to New Caledonia was checked, and the colony became almost exclusively penal. The natural growth of a prosperous colonial community made no advance, and convict labour did little to stimulate it, the public works, essential for development, and construction of roads were neglected; there was no extensive clearance of lands, no steady development of agriculture. From 1898 simple deportation practically ceased, but the islands were full of convicts already sent, and they still received the product of the latest invention in the criminal code known as "relegation," a punishment directed against the recidivist or incorrigible criminal whom no penal retribution had hitherto touched and whom the French law felt justified in banishing for ever to the "back of beyond." A certain period of time spent in a hard labour prison preceded relegation, but the convicts on arrival were generally unfitted to assist in colonization. They were for the most part decadent, morally and physically; their labour was of no substantial value to

colonists or themselves, and there was small hope of profitable result when they gained conditional liberation, with a concession of colonial land and a possibility of rehabilitation by their own efforts abroad, for by their sentence they were forbidden to hope for return to France. The punishment of relegation was not long in favour, the number of sentences to it fell year after year, and it has now been practically abandoned.

Other Countries.—Penal exile has been practised by some other countries as a method of secondary punishment. Russia since 1823 has directed a stream of offenders, mainly political, upon Siberia, and at one time the yearly average sent was 18,000. The Siberian exile system, the horrors of which cannot be exaggerated, belongs only in part to penitentiary science, but it was very distinctly punitive and aimed at regeneration of the individual and the development of the soil by new settlements. Although the journey was made mostly on foot and not by sea transport, the principle of deportation (or more exactly of removal) was the essence of the system. The later practice, however, has been exactly similar to transportation as originated by England and afterwards followed by France. The penal colonization of the island of Sakhalin reproduced the preceding methods, and the Russian convicts were conveyed by ships through the Suez Canal to the Far East. Sakhalin was hopefully intended as an outlet for released convicts and their rehabilitation by their own efforts, precisely in the manner tried in Australia and New Caledonia. The result repeated previous experiences. There was land to reclaim, forests to cut down, marshes to drain, everything but a temperate climate and a good will of the felon labourers to create a prosperous colony. But the convicts would not work; a few sought to win the right to occupy a concession of soil, but the bulk were pure vagabonds, wandering to and fro in search of food. The agricultural enterprise was a complete failure. The wrong sites for cultivation were chosen, the labourers were unskilled and they handled very indifferent tools. Want amounting to constant starvation was a constant rule; the rations were insufficient and unwholesome, very little meat eked out with salt fish and with entire absence of vegetables. The general tone of morals was inconceivably low, and a universal passion for alcohol and card-playing prevailed. According to one authority the life of the convicts at Sakhalin was a frightful nightmare, "a mixture of debauchery and innocence mixed with real sufferings and almost inconceivable privations, corrupt in every one of its phases." The prisons hopelessly ruined all who entered them, all classes were indiscriminately herded together. It is now generally allowed that deportation, as practised, had utterly failed, the chief reasons being the unmanageable numbers sent and the absence of outlets for their employment, even at great cost.

The prisons on Sakhalin have been described as hotbeds of vice; the only classification of prisoners is one based on the length of sentence. Some imperfect attempt is made to separate those waiting trial from the recidivist or hardened offender, but too often the association is indiscriminate. Prison discipline is generally slack and ineffective, the staff of warders, from ill-judged economy, too weak to supervise or control. The officers themselves are of inferior stamp, drunken, untrustworthy, overbearing, much given to "trafficking" with the prisoners, accepting bribes to assist escape, quick to misuse and oppress their charges. Crime of the worst description is common.

Italy has practised deportation in planting various agricultural colonies upon the islands to be found on her coast. They were meant to imitate the intermediate prisons of the Irish system, where prisoners might work out their redemption, when provisionally released. Two were established on the islands of Pianoso and Gorgona, and there were settlements made on Monte Christo and Capraia. They were used also to give effect to the system of enforced residence or *domicilio coatto*.

Portugal also has tried deportation to the African colony of Angola on a small scale with some success, and combined it with free emigration. The settlers have been represented as well disposed towards the convicts, gladly obtaining their services or helping them in the matter of security. The convict element is orderly, and, although their treatment is "*peu repressive et relativement debonnaire*," few commit offences.

The Andaman Islands have been utilized by the Indian government since the mutiny (1857) for the deportation of heinous criminals (see ANDAMAN ISLANDS).

AUTHORITIES.—Captain A. Phillip, R.N., *The Voyage of Governor Phillip to New South Wales* (1790); David Collins, *Account of the English Colony of New South Wales* (1798); Archbishop Whately, *Remarks on Transportation* (1834); Herman Merivale, *Colonization and Colonies* (1841); d'Haussonville, *Établissements pénitentiaires en France et aux colonies* (1875); George Griffith, *In a Prison Land*; Cuche, *Science et législation pénitentiaire* (1905); Hawes, *The Uttermost East* (1906). (A. G.)

DEPOSIT (Lat. *depositum*, from *deponere*, to lay down, to put in the care of), anything laid down or separated; as in geology, any mass of material accumulated by a natural agency (see BED), and in chemistry, a precipitate or matter settling from a solution or suspension. In banking, a deposit may mean, generally, a sum of money lodged in a bank without regard to the conditions under which it is held, but more specially money lodged with a bank on "deposit account" and acknowledged by the banker by a "deposit receipt" given to the depositor. It is then not drawn upon by cheque, usually bears interest at a rate varying from time to time, and can only be withdrawn after fixed notice. Deposit is also used in the sense of earnest or security for the performance of a contract. In the law of mortgage the deposit of title-deeds is usual as a security for the repayment of money advanced. Such a deposit operates as an equitable mortgage. In the law of contract, deposit or simple bailment is delivery or bailment of goods in trust to be kept without recompense, and redelivered on demand (see BAILMENT).

DEPOT (from the Fr. *dépôt*, Lat. *depositum*, laid down; the French accent marks are usually dispensed with in English), a place where things may be stored or deposited, such as a furniture or forage depot, the accumulation of military stores, especially in the theatre of operations. In America the word is used of a railway station, whether for passengers or goods; in Great Britain on railways the word, when in use, is applied to goods stations. A particular military application is to a depot, situated as a rule in the centre of the recruiting district of the regiment or other unit, where recruits are received and undergo the necessary preliminary training before joining the active troops. Such depots are maintained in peace time by all armies which have to supply distant or oversea garrisons; in an army raised by compulsory service and quartered in its own country, the regiments are usually stationed in their own districts, and on their taking the field for war leave behind a small nucleus for the formation and training of drafts to be sent out later. These nucleus troops are generically called depot troops.

DEPRETIS, AGOSTINO (1813–1887), Italian statesman, was born at Mezzana Corte, in the province of Stradella on the 31st of January 1813. From early manhood a disciple of Mazzini and affiliated to the *Giovane Italia*, he took an active part in the Mazzinian conspiracies and was nearly captured by the Austrians while smuggling arms into Milan. Elected deputy in 1848, he joined the Left and founded the journal *Il Diritto*, but held no official position until appointed governor of Brescia in 1859. In 1860 he went to Sicily on a mission to reconcile the policy of Cavour (who desired the immediate incorporation of the island in the kingdom of Italy) with that of Garibaldi, who wished to postpone the Sicilian *plébiscite* until after the liberation of Naples and Rome. Though appointed pro-dictator of Sicily by Garibaldi, he failed in his attempt. Accepting the portfolio of public works in the Rattazzi cabinet in 1862, he served as intermediary in arranging with Garibaldi the expedition which ended disastrously at Aspromonte. Four years later, on the outbreak of war against Austria, he entered the Ricasoli cabinet as minister of marine, and, by maintaining Admiral Persano in command of the fleet, contributed to the defeat of Lissa. His apologists contend, however, that, as an inexperienced civilian, he could not have made sudden changes in naval arrangements without disorganizing the fleet, and that in view of the impending hostilities he was

obliged to accept the dispositions of his predecessors. Upon the death of Rattazzi in 1873, Depretis became leader of the Left, prepared the advent of his party to power, and was called upon to form the first cabinet of the Left in 1876. Overthrown by Cairoli in March 1878 on the grist-tax question, he succeeded, in the following December, in defeating Cairoli, became again premier, but on the 3rd of July 1879 was once more overturned by Cairoli. In November 1879 he, however, entered the Cairoli cabinet as minister of the interior, and in May 1881 succeeded to the premiership, retaining that office until his death on the 29th of July 1887. During the long interval he recomposed his cabinet four times, first throwing out Zanardelli and Baccarini in order to please the Right, and subsequently bestowing portfolios upon Ricotti, Robilant and other Conservatives, so as to complete the political process known as "trasformismo." A few weeks before his death he repented of his transformist policy, and again included Crispi and Zanardelli in his cabinet. During his long term of office he abolished the grist tax, extended the suffrage, completed the railway system, aided Mancini in forming the Triple Alliance, and initiated colonial policy by the occupation of Massawa; but, at the same time, he vastly increased indirect taxation, corrupted and destroyed the fibre of parliamentary parties, and, by extravagance in public works, impaired the stability of Italian finance.

DEPTFORD, a south-eastern metropolitan borough of London, England, bounded N. by Bermondsey, E. by the river Thames and Greenwich, S. by Lewisham and W. by Camberwell. Pop. (1901) 110,398. The name is connected with a ford over the Ravensbourne, a stream entering the Thames through Deptford Creek. The borough comprises only the parish of Deptford St Paul, that of Deptford St Nicholas being included in the borough of Greenwich. Deptford is a district of poor streets, inhabited by a large industrial population, employed in engineering and other riverside works. On the river front, extending into the borough of Greenwich, are the royal victualling yard and the site of the old Deptford dockyard. The first supplies the navy with provisions, medicines, furniture, &c., manufactured or stored in the large warehouses here. The dockyard ceased to be used in 1869, and was filled up and converted into a foreign cattle market by the City Corporation. Of public buildings the most noteworthy are St Paul's church (1730), of classic design; the municipal buildings; and the hospital for master mariners, maintained by the corporation of the Trinity House, which was founded at Deptford, the old hall being pulled down in 1787. Other institutions are the Goldsmiths' Polytechnic Institute, New Cross; and the South-eastern fever hospital. A mansion known as Sayes Court, taken down in 1729, was the residence of the duke of Sussex in the reign of Elizabeth; it was occupied in the following century by John Evelyn, author of *Sylva*, and by Peter the Great during his residence in England in 1698. The site of its gardens is occupied by Deptford Park of 11 acres. Another open space is Telegraph Hill (9½ acres). The parliamentary borough of Deptford returns one member. The borough council consists of a mayor, 6 aldermen, and 36 councillors. Area, 1562·7 acres.

DEPUTY (through the Fr. from a Late Lat. use of *deputare*, to cut off, allot; *putare* having the original sense of to trim, prune), one appointed to act or govern instead of another; one who exercises an office in another man's right, a substitute; in representative government a member of an elected chamber. In general, the powers and duties of a deputy are those of his principal (see also REPRESENTATION), but the extent to which he may exercise them is dependent upon the power delegated to him. He may be authorized to exercise the whole of his principal's office, in which case he is a general deputy, or to act only in some particular matter or service, when he is termed a special deputy. In the United Kingdom various officials are specifically empowered by statute to appoint deputies to act for them under certain circumstances. Thus a clerk of the peace, in case of illness, incapacity or absence, may appoint a fit person to act as his deputy. While judges of the supreme court cannot act by deputy, county court judges and recorders can, in cases of illness or unavoidable absence, appoint deputies. So can registrars of county courts and returning officers at elections.

DE QUINCEY, THOMAS (1785–1859), English author, was born at Greenheys, Manchester, on the 15th of August 1785. He was the fifth child in a family of eight (four sons and four daughters). His father, descended from a Norman family, was a merchant, who left his wife and six children a clear income of £1600 a year. Thomas was from infancy a shy, sensitive child, with a constitutional tendency to dreaming by night and by day; and, under the influence of an elder brother, a lad "whose genius for mischief amounted to inspiration," who died in his sixteenth year, he spent much of his boyhood in imaginary worlds of their own creating. The amusements and occupations of the whole family, indeed, seem to have been mainly intellectual; and in De Quincey's case, emphatically, "the child was father to the man." "My life has been," he affirms in the *Confessions*, "on the whole the life of a philosopher; from my birth I was made an intellectual creature, and intellectual in the highest sense my pursuits and pleasures have been." From boyhood he was more or less in contact with a polished circle; his education, easy to one of such native aptitude, was sedulously attended to. When he was in his twelfth year the family removed to Bath, where he was sent to the grammar school, at which he remained for about two years; and for a year more he attended another public school at Winkfield, Wiltshire. At thirteen he wrote Greek with ease; at fifteen he not only composed Greek verses in lyric measures, but could converse in Greek fluently and without embarrassment; one of his masters said of him, "that boy could harangue an Athenian mob better than you or I could address an English one." Towards the close of his fifteenth year he visited Ireland, with a companion of his own age, Lord Westport, the son of Lord Altamont, an Irish peer, and spent there in residence and travel some months of the summer and autumn of the year 1800,—being a spectator at Dublin of "the final ratification of the bill which united Ireland to Great Britain." On his return to England, his mother having now settled at St John's Priory, a residence near Chester, De Quincey was sent to the Manchester grammar school, mainly in the hope of securing one of the school exhibitions to help his expenses at Oxford.

Discontented with the mode in which his guardians conducted his education, and with some view apparently of forcing them to send him earlier to college, he left this school after less than a year's residence—ran away, in short, to his mother's house. There his mother's brother, Colonel Thomas Penson, made an arrangement for him to have a weekly allowance, on which he might reside at some country place in Wales, and pursue his studies, presumably till he could go to college. From Wales, however, after brief trial, "suffering grievously from want of books," he went off as he had done from school, and hid himself from guardians and friends in the world of London. And now, as he says, commenced "that episode, or impassioned parenthesis of my life, which is comprehended in *The Confessions of an English Opium Eater*." This London episode extended over a year or more; his money soon vanished, and he was in the utmost poverty; he obtained shelter for the night in Greek Street, Soho, from a moneylender's agent, and spent his days wandering in the streets and parks; finally the lad was reconciled to his guardians, and in 1803 was sent to Worcester College, Oxford, being by this time about nineteen. It was in the course of his second year at Oxford that he first tasted opium,—having taken it to allay neuralgic pains. De Quincey's mother had settled at Weston Lea, near Bath, and on one of his visits to Bath, De Quincey made the acquaintance of Coleridge; he took Mrs Coleridge to Grasmere, where he became personally acquainted with Wordsworth.

After finishing his career of five years at college in 1808 he kept terms at the Middle Temple; but in 1809 visited the Wordsworths at Grasmere, and in the autumn returned to Dove Cottage, which he had taken on a lease. His choice was of course influenced partly by neighbourhood to Wordsworth, whom he early appreciated,—having been, he says, the only man

in all Europe who quoted Wordsworth so early as 1802. His friendship with Wordsworth decreased within a few years, and when in 1834 De Quincey published in *Tait's Magazine* his reminiscences of the Grasmere circle, the indiscreet references to the Wordsworths contained in the article led to a complete cessation of intercourse. Here also he enjoyed the society and friendship of Coleridge, Southey and especially of Professor Wilson, as in London he had of Charles Lamb and his circle. He continued his classical and other studies, especially exploring the at that time almost unknown region of German literature, and indicating its riches to English readers. Here also, in 1816, he married Margaret Simpson, the "dear M——" of whom a charming glimpse is accorded to the reader of the *Confessions*; his family came to be five sons and three daughters.

For about a year and a half he edited the *Westmoreland Gazette*. He left Grasmere for London in the early part of 1820. The Lambs received him with great kindness and introduced him to the proprietors of the *London Magazine*. It was in this journal in 1821 that the *Confessions* appeared. De Quincey also contributed to *Blackwood*, to *Knight's Quarterly Magazine*, and later to *Tait's Magazine*. His connexion with *Blackwood* took him to Edinburgh in 1828, and he lived there for twelve years, contributing from time to time to the *Edinburgh Literary Gazette*. His wife died in 1837, and the family eventually settled at Lasswade, but from this time De Quincey spent his time in lodgings in various places, staying at one place until the accumulation of papers filled the rooms, when he left them in charge of the landlady and wandered elsewhere. After his wife's death he gave way for the fourth time in his life to the opium habit, but in 1844 he reduced his daily quantity by a tremendous effort to six grains, and never again yielded. He died in Edinburgh on the 8th of December 1859, and is buried in the West Churchyard.

During nearly fifty years De Quincey lived mainly by his pen. His patrimony seems never to have been entirely exhausted, and his habits and tastes were simple and inexpensive; but he was reckless in the use of money, and had debts and pecuniary difficulties of all sorts. There was, indeed, his associates affirm, an element of romance even in his impecuniosity, as there was in everything about him; and the diplomatic and other devices by which he contrived to keep clear of clamant creditors, while scrupulously fulfilling many obligations, often disarmed animosity, and converted annoyance into amusement. The famous *Confessions of an English Opium Eater* was published in a small volume in 1822, and attracted a very remarkable degree of attention, not simply by its personal disclosures, but by the extraordinary power of its dream-painting. No other literary man of his time, it has been remarked, achieved so high and universal a reputation from such merely fugitive efforts. The only works published separately (not in periodicals) were a novel, *Klosterheim* (1832), and *The Logic of Political Economy* (1844). After his works were brought together, De Quincey's reputation was not merely maintained, but extended. For range of thought and topic, within the limits of pure literature, no like amount of material of such equality of merit proceeded from any eminent writer of the day. However profuse and discursive, De Quincey is always polished, and generally exact—a scholar, a wit, a man of the world and a philosopher, as well as a genius. He looked upon letters as a noble and responsible calling; in his essay on Oliver Goldsmith he claims for literature the rank not only of a fine art, but of the highest and most potent of fine arts; and as such he himself regarded and practised it. He drew a broad distinction between "the literature of *knowledge* and the literature of *power*," asserting that the function of the first is to *teach*, the function of the second to *move*,—maintaining that the meanest of authors who moves has pre-eminence over all who merely teach, that the literature of knowledge must perish by supersession, while the literature of power is "triumphant for ever as long as the language exists in which it speaks." It is to this class of motive literature that De Quincey's own works essentially belong; it is by virtue of that vital element of power that they have emerged from the rapid oblivion of periodicalism, and live in the minds of later generations. But their power is weakened by their volume.

De Quincey fully defined his own position and claim to distinction in the preface to his collected works. These he divides into three classes:—"*first*, that class which proposes primarily to amuse the reader," such as the *Narratives*, *Autobiographic Sketches*, &c.; "*second*, papers which address themselves purely to the understanding as an insulated faculty, or do so primarily," such as the essays on Essenism, the Caesars, Cicero, &c.; and finally, as a *third* class, "and, in virtue of their aim, as a far higher class of compositions," he ranks those "modes of impassioned prose ranging under no precedents that I am aware of in any literature," such as the *Confessions* and *Suspiria de Profundis*. The high claim here asserted has been questioned; and short and isolated examples of eloquent apostrophe, and highly wrought imaginative description, have been cited from Rousseau and other masters of style; but De Quincey's power of sustaining a fascinating and elevated strain of "impassioned prose" is allowed to be entirely his own. Nor, in regard to his writings as a whole, will a minor general claim which he makes be disallowed, namely, that he "does not write without a thoughtful consideration of his subject," and also with novelty and freshness of view. "Generally," he says, "I claim (not arrogantly, but with firmness) the merit of rectification applied to absolute errors, or to injurious limitations of the truth." Another obvious quality of all his genius is its overflowing fulness of allusion and illustration, recalling his own description of a great philosopher or scholar—"Not one who depends simply on an infinite memory, but also on an infinite and electrical power of combination, bringing together from the four winds, like the angel of the resurrection, what else were dust from dead men's bones into the unity of breathing life." It is useless to complain of his having lavished and diffused his talents and acquirements over so vast a variety of often comparatively trivial and passing topics. The world must accept gifts from men of genius as they offer them; circumstance and the hour often rule their form. Those influences, no less than the idiosyncrasy of the man, determined De Quincey to the illumination of such matter for speculation as seemed to lie before him; he was not careful to search out recondite or occult themes, though these he did not neglect,—a student, a scholar and a recluse, he was yet at the same time a man of the world, keenly interested in the movements of men and in the page of history that unrolled itself before him day by day. To the discussion of things new, as readily as of things old, aided by a capacious, retentive and ready memory, which dispensed with reference to printed pages, he brought also the exquisite keenness and subtlety of his highly analytic and imaginative intellect, the illustrative stores of his vast and varied erudition, and that large infusion of common sense which preserved him from becoming at any time a mere *doctrinaire*, or visionary. If he did not throw himself into any of the great popular controversies or agitations of the day, it was not from any want of sympathy with the struggles of humanity or the progress of the race, but rather because his vocation was to apply to such incidents of his own time, as to like incidents of all history, great philosophical principles and tests of truth and power. In politics, in the party sense of that term, he would probably have been classed as a Liberal Conservative or Conservative Liberal—at one period of his life perhaps the former, and at a later the latter. Originally, as we have seen, his surroundings were aristocratic, in his middle life his associates, notably Wordsworth, Southey and Wilson, were all Tories; but he seems never to have held the extreme and narrow views of that circle. Though a flavour of high breeding runs through his writings, he has no vulgar sneers at the vulgar. As he advanced in years his views became more and more decidedly liberal, but he was always as far removed from Radicalism as from Toryism, and may be described as a philosophical politician, capable of classification under no definite party name or colour. Of political economy he had been an early and earnest student, and projected, if he did not so far proceed with, an elaborate and systematic treatise on the science, of which all that appears, however, are his fragmentary *Dialogues* on the system of Ricardo, published in the *London Magazine* in 1824, and *The Logic of Political Economy* (1844). But political

and economic problems largely exercised his thoughts, and his historical sketches show that he is constantly alive to their interpenetrating influence. The same may be said of his biographies, notably of his remarkable sketch of Dr Parr. Neither politics nor economics, however, exercised an absorbing influence on his mind,—they were simply provinces in the vast domain of universal speculation through which he ranged "with unconfined wings." How wide and varied was the region he traversed a glance at the titles of the papers which make up his collected—or more properly, selected—works (for there was much matter of evanescent interest not reprinted) sufficiently shows. Some things in his own line he has done perfectly; he has written many pages of magnificently mixed argument, irony, humour and eloquence, which, for sustained brilliancy, richness, subtle force and purity of style and effect, have simply no parallels; and he is without peer the prince of dreamers. The use of opium no doubt stimulated this remarkable faculty of reproducing in skilfully selected phrase the grotesque and shifting forms of that "cloudland, gorgeous land," which opens to the sleep-closed eye.

To the appreciation of De Quincey the reader must bring an imaginative faculty somewhat akin to his own—a certain general culture, and large knowledge of books, and men and things. Otherwise much of that slight and delicate allusion that gives point and colour and charm to his writings will be missed; and on this account the full enjoyment and comprehension of De Quincey must always remain a luxury of the literary and intellectual. But his skill in narration, his rare pathos, his wide sympathies, the pomp of his dream-descriptions, the exquisite playfulness of his lighter dissertations, and his abounding though delicate and subtle humour, commend him to a larger class. Though far from being a professed humorist—a character he would have shrunk from—there is no more expert worker in a sort of half-veiled and elaborate humour and irony than De Quincey; but he employs those resources for the most part secondarily. Only in one instance has he given himself up to them unreservedly and of set purpose, namely, in the famous "Essay on Murder considered as one of the Fine Arts," published in *Blackwood*,—an effort which, admired and admirable though it be, is also, it must be allowed, somewhat strained. His style, full and flexible, pure and polished, is peculiarly his own; yet it is not the style of a mannerist,—its charm is, so to speak, latent; the form never obtrudes; the secret is only discoverable by analysis and study. It consists simply in the reader's assurance of the writer's complete mastery over all the infinite applicability and resources of the English language. Hence involutions and parentheses, "cycle on epicycle," evolve themselves into a stately clearness and harmony; and sentences and paragraphs, loaded with suggestion, roll on smoothly and musically, without either fatiguing or cloying—rather, indeed, to the surprise as well as delight of the reader; for De Quincey is always ready to indulge in feats of style, witching the world with that sort of noble horsemanship which is as graceful as it is daring.

It has been complained that, in spite of the apparently full confidences of the *Confessions* and *Autobiographic Sketches*, readers are left in comparative ignorance, biographically speaking, of the man De Quincey. Two passages in his *Confessions* afford sufficient clues to this mystery. In one he describes himself "as framed for love and all gentle affections," and in another confesses to the "besetting infirmity" of being "too much of an eudaemonist." "I hanker," he says, "too much after a state of happiness, both for myself and others; I cannot face misery, whether my own or not, with an eye of sufficient firmness, and am little capable of surmounting present pain for the sake of any recessionary benefit." His sensitive disposition dictated the ignoring in his writings of traits merely personal to himself, as well as his ever-recurrent resort to opium as a doorway of escape from present ill; and prompted those habits of seclusion, and that apparently capricious abstraction of himself from the society not only of his friends, but of his own family, in which he from time to time persisted. He confessed to occasional accesses of an almost irresistible impulse to flee to the labyrinthine shelter of some great city like London or Paris,—there to dwell solitary amid a multitude, buried by day in the cloister-like recesses of mighty libraries, and stealing away by night to some obscure lodging. Long indulgence in seclusion, and in habits of study the most lawless possible in respect of regular hours or any considerations of health or comfort,—the habit of working as pleased himself without regard to the divisions of night or day, of times of sleeping or waking, even of the slow procession of the seasons, had latterly so disinclined him to the restraints, however slight, of ordinary social intercourse, that he very seldom submitted to them. On such rare occasions, however, as he did appear, perhaps at some simple meal with a favoured friend, or in later years in his own small but refined domestic circle, he was the most charming of guests, hosts or companions. A short and fragile, but well-proportioned frame; a shapely and compact head; a face beaming with intellectual light, with rare, almost feminine beauty of feature and complexion; a fascinating courtesy of manner; and a fulness, swiftness and elegance of silvery speech,—such was the irresistible "mortal mixture of earth's mould" that men named De Quincey. He possessed in a high degree what James Russell Lowell called "the grace of perfect breeding, everywhere persuasive, and nowhere emphatic"; and his whole aspect and manner exercised an undefinable attraction over every one, gentle or simple, who came within its influence; for shy as he was, he was never rudely shy, making good his boast that he had always made it his "pride to converse familiarly *more socratico* with all human beings—man, woman and child"—looking on himself as a catholic creature standing in an equal relation to high and low, to educated and uneducated. He would converse with a peasant lad or a servant girl in phrase as choice, and sentences as sweetly turned, as if his interlocutor were his equal both in position and intelligence; yet without a suspicion of pedantry, and with such complete adaptation of style and topic that his talk charmed the humblest as it did the highest that listened to it. His conversation was not a monologue; if he had the larger share, it was simply because his hearers were only too glad that it should be so; he would listen with something like deference to very ordinary talk, as if the mere fact of the speaker being one of the same company entitled him to all consideration and respect. The natural bent of his mind and disposition, and his life-long devotion to letters, to say nothing of his opium eating, rendered him, it must be allowed, regardless of ordinary obligations in life—domestic and pecuniary—to a degree that would have been culpable in any less singularly constituted mind. It was impossible to deal with or judge De Quincey by ordinary standards—not even his publishers did so. Much no doubt was forgiven him, but all that needed forgiveness is covered by the kindly veil of time, while his merits as a master in English literature are still gratefully acknowledged.[1]

[BIBLIOGRAPHY.—In 1853 De Quincey began to prepare an edition of his works, *Selections Grave and Gay. Writings Published and Unpublished* (14 vols., Edinburgh, 1853–1860), followed by a second edition (1863–1871) with notes by James Hogg and two additional volumes; a further supplementary volume appeared in 1878. The first comprehensive edition, however, was printed in America (Boston, 20 vols., 1850–1855); and the "Riverside" edition (Boston and New York, 12 vols., 1877) is still fuller. The standard English edition is *The Collected Writings of Thomas De Quincey* (14 vols., Edinburgh, 1889–1890), edited by David Masson, who also wrote his biography (1881) for the "English Men of Letters" series. The *Uncollected Writings of Thomas De Quincey* (London, 2 vols., 1890) contains a preface and annotations by James Hogg; *The Posthumous Writings of Thomas De Quincey* (2 vols., 1891–1893) were edited by A. H. Japp ("H. A. Page"), who wrote the standard biography, *Thomas De Quincey: his Life and Writings* (London, 2 vols., 2nd ed., 1879), and *De Quincey Memorials* (2 vols., 1891). See also Arvède Barine, *Nevroses* (Paris, 1898); Sir L. Stephen, *Hours in a Library*; H. S. Salt, *De Quincey* (1904); and *De Quincey and his Friends* (1895), a collection edited by James Hogg, which includes essays by Dr Hill Burton and Shadworth Hodgson.] (J. R. F.)

[1] The above account has been corrected and amplified in some statements of fact for this edition. Its original author, John Ritchie Findlay (1824–1898), proprietor of *The Scotsman* newspaper, and the donor of the Scottish National Portrait Gallery in Edinburgh, had been intimate with De Quincey, and in 1886 published his *Personal Recollections* of him.

DERA GHAZI KHAN, a town and district of British India, in the Punjab. In 1901 the town had a population of 21,700. There are several handsome mosques in the native quarter. It commands the direct approaches to the Baluch highlands by Sakki Sarwar and Fort Monro. For many years past both the town and cantonment have been threatened by the erosion of the river Indus. The town was founded at the close of the 15th century and named after Ghazi Khan, son of Haji Khan, a Baluch chieftain, who after holding the country for the Langah sultans of Multan had made himself independent. Together with the two other *deras* (settlements), Dera Ismail Khan and Dera Fateh Khan, it gave its name to the territorial area locally and historically known as Derajat, which after many vicissitudes came into the possession of the British after the Sikh War, in 1849, and was divided into the two districts of Dera Ghazi Khan and Dera Ismail Khan.

The DISTRICT OF DERA GHAZI KHAN contains an area of 5306 sq. m. The district is a long narrow strip of country, 198 m. in length, sloping gradually from the hills which form its western boundary to the river Indus on the east. Below the hills the country is high and arid, generally level, but sometimes rolling in sandy undulations, and much intersected by hill torrents, 201 in number. With the exceptions of two, these streams dry up after the rains, and their influence is only felt for a few miles below the hills. The eastern portion of the district is at a level sufficiently low to benefit by the floods of the Indus. A barren tract intervenes between these zones, and is beyond the reach of the hill streams on the one hand and of the Indus on the other. Although liable to great extremes of temperature, and to a very scanty rainfall, the district is not unhealthy. The population in 1901 was 471,149, the great majority being Baluch Mahommedans. The principal exports are wheat and indigo. The only manufactures are for domestic use. There is no railway in the district, and only 29 m. of metalled road. The Indus, which is nowhere bridged within the district, is navigable by native boats. The geographical boundary between the Pathan and Baluch races in the hills nearly corresponds with the northern limit of the district. The frontier tribes on the Dera Ghazi Khan border include the Kasranis, Bozdars, Khosas, Lagharis, Khetvans, Gurchanis, Mazaris, Mariris and Bugtis. The chief of these are described under their separate names.

DERA ISMAIL KHAN, a town and district in the Derajat division of the North-West Frontier Province of India. The town is situated near the right bank of the Indus, which is here crossed by a bridge of boats during half the year. In 1901 it had a population of 31,737. It takes its name from Ismail Khan, a Baluch chief who settled here towards the end of the 15th century, and whose descendants ruled for 300 years. The old town was swept away by a flood in 1823, and the present town stands 4 m. back from the permanent channel of the river. The native quarters are well laid out, with a large bazaar for Afghan traders. It is the residence of many Mahommedan gentry. The cantonment accommodates about a brigade of troops. There is considerable through trade with Afghanistan by the Gomal Pass, and there are local manufactures of cotton cloth scarves and inlaid wood-work.

The DISTRICT OF DERA ISMAIL KHAN contains an area of 3403 sq. m. It was formerly divided into two almost equal portions by the Indus, which intersected it from north to south. To the west of the Indus the characteristics of the country resemble those of Dera Ghazi Khan. To the east of the present bed of the river there is a wide tract known as the *Kachi*, exposed to river action. Beyond this, the country rises abruptly, and a barren, almost desert plain stretches eastwards, sparsely cultivated, and inhabited only by nomadic tribes of herdsmen. In 1901 the trans-Indus tract was allotted to the newly formed North-West Frontier Province, the cis-Indus tract remaining in the Punjab jurisdiction. The cis-Indus portions of the Dera Ismail Khan and Bannu districts now comprise the new Punjab district of Mianiwali. In 1901 the population was 252,379, chiefly Pathan and Baluch Mahommedans. Wheat and wool are exported.

The Indus is navigable by native boats throughout its course of 120 m. within the district, which is the borderland of Pathan and Baluch tribes, the Pathan element predominating. The chief frontier tribes are the Sheranis and Ustaranas.

DERBENT, or DERBEND, a town of Russia, Caucasia, in the province of Daghestan, on the western shore of the Caspian, 153 m. by rail N.W. of Baku, in 42° 4′ N. and 48° 15′ E. Pop. (1873) 15,739; (1897) 14,821. It occupies a narrow strip of land beside the sea, from which it climbs up the steep heights inland to the citadel of Naryn-kaleh, and is on all sides except towards the east surrounded by walls built of porous limestone. Its general aspect is Oriental, owing to the flat roofs of its two-storeyed houses and its numerous mosques. The environs are occupied by vineyards, gardens and orchards, in which madder, saffron and tobacco, as well as figs, peaches, pears and other fruits, are cultivated. Earthenware, weapons and silk and cotton fabrics are the principal products of the manufacturing industry. To the north of the town is the monument of the *Kirk-lar*, or "forty heroes," who fell defending Daghestan against the Arabs in 728; and to the south lies the seaward extremity of the Caucasian wall (50 m. long), otherwise known as Alexander's wall, blocking the narrow pass of the Iron Gate or Caspian Gates (*Portae Albanae* or *Portae Caspiae*). This, when entire, had a height of 29 ft. and a thickness of about 10 ft., and with its iron gates and numerous watch-towers formed a valuable defence of the Persian frontier. Derbent is usually identified with Albana, the capital of the ancient Albania. The modern name, a Persian word meaning "iron gates," came into use in the end of the 5th or the beginning of the 6th century, when the city was refounded by Kavadh of the Sassanian dynasty of Persia. The walls and the citadel are believed to belong to the time of Kavadh's son, Khosrau (Chosroes) Anosharvan. In 728 the Arabs entered into possession, and established a principality in the city, which they called Bab-el-Abwab ("the principal gate"), Bab-el-Khadid ("the iron gate"), and Seraill-el-Dagab ("the golden throne"). The celebrated caliph, Harun-al-Rashid, lived in Derbent at different times, and brought it into great repute as a seat of the arts and commerce. In 1220 it was captured by the Mongols, and in the course of the succeeding centuries it frequently changed masters. In 1722 Peter the Great of Russia wrested the town from the Persians, but in 1736 the supremacy of Nadir Shah was again recognized. In 1796 Derbent was besieged by the Russians, and in 1813 incorporated with the Russian empire.

DERBY, EARLS OF. The 1st earl of Derby was probably Robert de Ferrers (d. 1139), who is said by John of Hexham to have been made an earl by King Stephen after the battle of the Standard in 1138. Robert and his descendants retained the earldom until 1266, when Robert (*c.* 1240–*c.* 1279), probably the 6th earl, having taken a prominent part in the baronial rising against Henry III., was deprived of his lands and practically of his title. These earlier earls of Derby were also known as Earls Ferrers, or de Ferrers, from their surname; as earls of Tutbury from their residence; and as earls of Nottingham because this county was a lordship under their rule. The large estates which were taken from Earl Robert in 1266 were given by Henry III. in the same year to his son, Edmund, earl of Lancaster; and Edmund's son, Thomas, earl of Lancaster, called himself Earl Ferrers. In 1337 Edmund's grandson, Henry (*c.* 1299–1361), afterwards duke of Lancaster, was created earl of Derby, and this title was taken by Edward III.'s son, John of Gaunt, who had married Henry's daughter, Blanche. John of Gaunt's son and successor was Henry, earl of Derby, who became king as Henry IV. in 1399.

In October 1485 Thomas, Lord Stanley, was created earl of Derby, and the title has since been retained by the Stanleys, who, however, have little or no connexion with the county of Derby. Thomas also inherited the sovereign lordship of the Isle of Man, which had been granted by the crown in 1406 to his great-grandfather, Sir John Stanley; and this sovereignty remained in possession of the earls of Derby till 1736, when it passed to the duke of Atholl.

The earl of Derby is one of the three "catskin earls," the others being the earls of Shrewsbury and Huntingdon. The term "catskin" is possibly a corruption of *quatre-skin*, derived from

the fact that in ancient times the robes of an earl (as depicted in some early representations) were decorated with four rows of ermine, as in the robes of a modern duke, instead of the three rows to which they were restricted in later centuries. The three "catskin" earldoms are the only earldoms now in existence which date from creations prior to the 17th century. (A. W. H.*)

THOMAS STANLEY, 1st earl of Derby (*c.* 1435–1504), was the son of Thomas Stanley, who was created Baron Stanley in 1456 and died in 1459. His grandfather, Sir John Stanley (d. 1414), had founded the fortunes of his family by marrying Isabel Lathom, the heiress of a great estate in the hundred of West Derby in Lancashire; he was lieutenant of Ireland in 1389–1391, and again in 1399–1401, and in 1405 received a grant of the lordship of Man from Henry IV. The future earl of Derby was a squire to Henry VI. in 1454, but not long afterwards married Eleanor, daughter of the Yorkist leader, Richard Neville, earl of Salisbury. At the battle of Blore Heath in August 1459 Stanley, though close at hand with a large force, did not join the royal army, whilst his brother William fought openly for York. In 1461 Stanley was made chief justice of Cheshire by Edward IV., but ten years later he sided with his brother-in-law Warwick in the Lancastrian restoration. Nevertheless, after Warwick's fall, Edward made Stanley steward of his household. Stanley served with the king in the French expedition of 1475, and with Richard of Gloucester in Scotland in 1482. About the latter date he married, as his second wife, Margaret Beaufort, mother of the exiled Henry Tudor. Stanley was one of the executors of Edward IV., and was at first loyal to the young king Edward V. But he acquiesced in Richard's usurpation, and retaining his office as steward avoided any entanglement through his wife's share in Buckingham's rebellion. He was made constable of England in succession to Buckingham, and granted possession of his wife's estates with a charge to keep her in some secret place at home. Richard could not well afford to quarrel with so powerful a noble, but early in 1485 Stanley asked leave to retire to his estates in Lancashire. In the summer Richard, suspicious of his continued absence, required him to send his eldest son, Lord Strange, to court as a hostage. After Henry of Richmond had landed, Stanley made excuses for not joining the king; for his son's sake he was obliged to temporize, even when his brother William had been publicly proclaimed a traitor. Both the Stanleys took the field; but whilst William was in treaty with Richmond, Thomas professedly supported Richard. On the morning of Bosworth (August 22), Richard summoned Stanley to join him, and when he received an evasive reply ordered Strange to be executed. In the battle it was William Stanley who turned the scale in Henry's favour, but Thomas, who had taken no part in the fighting, was the first to salute the new king. Henry VII. confirmed Stanley in all his offices, and on the 27th of October created him earl of Derby. As husband of the king's mother Derby held a great position, which was not affected by the treason of his brother William in February 1495. In the following July the earl entertained the king and queen with much state at Knowsley. Derby died on the 29th of July 1504. Strange had escaped execution in 1485, through neglect to obey Richard's orders; but he died before his father in 1497, and his son Thomas succeeded as second earl. An old poem called *The Song of the Lady Bessy*, which was written by a retainer of the Stanleys, gives a romantic story of how Derby was enlisted by Elizabeth of York in the cause of his wife's son.

For fuller narratives see J. Gairdner's *Richard III.* and J. H. Ramsay's *Lancaster and York*; also Seacome's *Memoirs of the House of Stanley* (1741). (C. L. K.)

EDWARD STANLEY, 3rd earl of Derby (1508–1572), was a son of Thomas Stanley, 2nd earl and grandson of the 1st earl, and succeeded to the earldom on his father's death in May 1521. During his minority Cardinal Wolsey was his guardian, and as soon as he came of age he began to take part in public life, being often in the company of Henry VIII. He helped to quell the rising in the north of England known as the Pilgrimage of Grace in 1536; but remaining true to the Roman Catholic faith he disliked and opposed the religious changes made under Edward VI. During Mary's reign the earl was more at ease, but under Elizabeth his younger sons, Sir Thomas (d. 1576) and Sir Edward Stanley (d. 1609), were concerned in a plot to free Mary, queen of Scots, and he himself was suspected of disloyalty. However, he kept his numerous dignities until his death at Lathom House, near Ormskirk, on the 24th of October 1572.

Derby's first wife was Katherine, daughter of Thomas Howard, duke of Norfolk, by whom he had, with other issue, a son Henry, the 4th earl (*c.* 1531–1593), who was a member of the Council of the North, and like his father was lord-lieutenant of Lancashire. Henry was one of the commissioners who tried Mary, queen of Scots, and was employed by Elizabeth on other high undertakings both at home and abroad. He died on the 25th of September 1593. His wife Margaret (d. 1596), daughter of Henry Clifford, 2nd earl of Cumberland, was descended through the Brandons from King Henry VII. Two of his sons, Ferdinando (*c.* 1559–1594), and William (*c.* 1561–1642), became in turn the 5th and 6th earls of Derby. Ferdinando, the 5th earl (d. 1594), wrote verses, and is eulogized by the poet Spenser under the name of Amyntas. (A. W. H.*)

JAMES STANLEY, 7th earl of Derby (1607–1651), sometimes styled the Great Earl of Derby, eldest son of William, 6th earl, and Elizabeth de Vere, daughter of Edward, 17th earl of Oxford, was born at Knowsley on the 31st of January 1607. During his father's life he was known as Lord Strange. After travelling abroad he was chosen member of parliament for Liverpool in 1625, was created knight of the Bath on the occasion of Charles's coronation in 1626, and was joined with his father the same year as lieutenant of Lancashire and Cheshire and chamberlain of Chester, and in the administration of the Isle of Man, being appointed subsequently lord-lieutenant of North Wales. On the 7th of March 1628 he was called up to the House of Lords as Baron Strange. He took no part in the political disputes between king and parliament and preferred country pursuits and the care of his estates to court or public life. Nevertheless when the Civil War broke out in 1642, Lord Strange devoted himself to the king's cause. His plan of securing Lancashire at the beginning and raising troops there, which promised success, was however discouraged by Charles, who was said to be jealous of his power and royal lineage and who commanded his presence at Nottingham. His subsequent attempts to recover the county were unsuccessful. He was unable to get possession of Manchester, was defeated at Chowbent and Lowton Moor, and in 1643 after gaining Preston failed to take Bolton and Lancaster castles. Finally, after successfully beating off Sir William Brereton's attack on Warrington, he was defeated at Whalley and withdrew to York, Warrington in consequence surrendering to the enemy's forces. In June he left for the Isle of Man to attend to affairs there, and in the summer of 1644 he took part in Prince Rupert's successful campaign in the north, when Lathom House, where Lady Derby had heroically resisted the attacks of the besiegers, was relieved, and Bolton Castle taken. He followed Rupert to Marston Moor, and after the complete defeat of Charles's cause in the north withdrew to the Isle of Man, where he held out for the king and offered an asylum to royalist fugitives. His administration of the island imitated that of Strafford in Ireland. It was strong rather than just. He maintained order, encouraged trade, remedied some abuses, and defended the people from the exactions of the church; but he crushed opposition by imprisoning his antagonists, and aroused a prolonged agitation by abolishing the tenant-right and introducing leaseholds. In July 1649 he refused scornfully terms offered to him by Ireton. By the death of his father on the 29th of September 1642 he had succeeded to the earldom, and on the 12th of January 1650 he obtained the Garter. He was chosen by Charles II. to command the troops of Lancashire and Cheshire, and on the 15th of August 1651 he landed at Wyre Water in Lancashire in support of Charles's invasion, and met the king on the 17th. Proceeding to Warrington he failed to obtain the support of the Presbyterians through his refusal to take the Covenant, and on the 25th was totally defeated at Wigan, being severely wounded and escaping with difficulty. He joined

Charles at Worcester; after the battle on the 3rd of September he accompanied him to Boscobel, and while on his way north alone was captured near Nantwich and given quarter. He was tried by court-martial at Chester on the 29th of September, and on the ground that he was a traitor and not a prisoner of war under the act of parliament passed in the preceding month, which declared those who corresponded with Charles guilty of treason, his quarter was disallowed and he was condemned to death. When his appeal for pardon to parliament was rejected, though supported by Cromwell, he endeavoured to escape; but was recaptured and executed at Bolton on the 15th of October 1651. He was buried in Ormskirk church. Lord Derby was a man of deep religious feeling and of great nobility of character, who though unsuccessful in the field served the king's cause with single-minded purpose and without expectation of reward. His political usefulness was handicapped in the later stages of the struggle by his dislike of the Scots, whom he regarded as guilty of the king's death and as unfit instruments of the restoration. According to Clarendon he was "a man of great honour and clear courage," and his defects the result of too little knowledge of the world. Lord Derby left in MS. "A Discourse concerning the Government of the Isle of Man" (printed in the *Stanley Papers* and in F. Peck's *Desiderata Curiosa*, vol. ii.) and several volumes of historical collections, observations, devotions (*Stanley Papers*) and a commonplace book. He married on the 26th of June 1626 Charlotte de la Tremoille (1599–1664), daughter of Claude, duc de Thouars, and granddaughter of William the Silent, prince of Orange, by whom besides four daughters he had five sons, of whom the eldest, Charles (1628-1672), succeeded him as 8th earl.

Charles's two sons, William, the 9th earl (*c.* 1655–1702), and James, the 10th earl (1664–1736), both died without sons, and consequently, when James died in February 1736, his titles and estates passed to Sir Edward Stanley (1689–1776), a descendant of the 1st earl. From him the later earls were descended, the 12th earl (d. 1834) being his grandson.

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EDWARD GEOFFREY SMITH STANLEY, 14th earl of Derby (1799–1869), the "Rupert of Debate," born at Knowsley in Lancashire on the 29th of March 1799, grandson of the 12th earl and eldest son of Lord Stanley, subsequently (1834) 13th earl of Derby (1775–1851). He was educated at Eton and at Christ Church, Oxford, where he distinguished himself as a classical scholar, though he took no degree. In 1819 he obtained the Chancellor's prize for Latin verse, the subject being "Syracuse." He gave early promise of his future eminence as an orator, and in his youth he used to practise elocution under the instruction of Lady Derby, his grandfather's second wife, the actress, Elizabeth Farren. In 1820 he was returned for Stockbridge in Hampshire, one of the nomination boroughs whose electoral rights were swept away by the Reform Bill of 1832, Stanley being a warm advocate of their destruction.

His maiden speech was delivered early in the session of 1824 in the debate on a private bill for lighting Manchester with gas. On the 6th of May 1824 he delivered a vehement and eloquent speech against Joseph Hume's motion for a reduction of the Irish Church establishment, maintaining in its most conservative form the doctrine that church property is as sacred as private property. From this time his appearances became frequent; and he soon asserted his place as one of the most powerful speakers in the House. Specially noticeable almost from the first was the skill he displayed in reply. Macaulay, in an essay published in 1834, remarked that he seemed to possess intuitively the faculty which in most men is developed only by long and laborious practice. In the autumn of 1824 Stanley went on an extended tour through Canada and the United States in company with Mr Labouchere, afterwards Lord Taunton, and Mr Evelyn Denison, afterwards Lord Ossington. In May of the following year he married the second daughter of Edward Bootle-Wilbraham, created Baron Skelmersdale in 1828, by whom he had a family of two sons and one daughter who survived.

At the general election of 1826 Stanley renounced his connection with Stockbridge, and became the representative of the borough of Preston, where the Derby influence was paramount. The change of seats had this advantage, that it left him free to speak against the system of rotten boroughs, which he did with great force during the Reform Bill debates, without laying himself open to the charge of personal inconsistency as the representative of a place where, according to Gay, cobblers used to "feast three years upon one vote." In 1827 he and several other distinguished Whigs made a coalition with Canning on the defection of the more unyielding Tories, and he commenced his official life as under-secretary for the colonies, but the coalition was broken up by Canning's death in August. Lord Goderich succeeded to the premiership, but he never was really in power, and he resigned his place after the lapse of a few months. During the succeeding administration of the duke of Wellington (1828–1830), Stanley and those with whom he acted were in opposition. His robust and assertive Liberalism about this period seemed curious afterwards to a younger generation who knew him only as the very embodiment of Conservatism.

By the advent of Lord Grey to power in November 1830, Stanley obtained his first opportunity of showing his capacity for a responsible office. He was appointed to the chief secretaryship of Ireland, a position in which he found ample scope for both administrative and debating skill. On accepting office he had to vacate his seat for Preston and seek re-election; and he had the mortification of being defeated by the Radical "orator" Hunt. The contest was a peculiarly keen one, and turned upon the question of the ballot, which Stanley refused to support. He re-entered the House as one of the members for Windsor, Sir Hussey Vivian having resigned in his favour. In 1832 he again changed his seat, being returned for North Lancashire.

Stanley was one of the most ardent supporters of Lord Grey's Reform Bill. Of this no other proof is needed than his frequent parliamentary utterances, which were fully in sympathy with the popular cry "The bill, the whole bill, and nothing but the bill." Reference may be made especially to the speech he delivered on the 4th of March 1831 on the adjourned debate on the second reading of the bill, which was marked by all the higher qualities of his oratory. Apart from his connexion with the general policy of the government, Stanley had more than enough to have employed all his energies in the management of his own department. The secretary of Ireland has seldom an easy task; Stanley found it one of peculiar difficulty. The country was in a very unsettled state. The just concession that had been somewhat tardily yielded a short time before in Catholic emancipation had excited the people to make all sorts of demands, reasonable and unreasonable. Undaunted by the fierce denunciations of O'Connell, who styled him Scorpion Stanley, he discharged with determination the ungrateful task of carrying a coercion bill through the House. It was generally felt that O'Connell, powerful though he was, had fairly met his match in Stanley, who, with invective scarcely inferior to his own, evaded no challenge, ignored no argument, and left no taunt unanswered. The title "Rupert of Debate" is peculiarly applicable to him in connexion with the fearless if also often reckless method of attack he showed in his parliamentary war with O'Connell. It was first applied to him, however, thirteen years later by Sir Edward Bulwer Lytton in *The New Timon*:—

> "One after one the lords of time advance;
> Here Stanley meets—here Stanley scorns the glance!
> The brilliant chief, irregularly great,
> Frank, haughty, rash,—the Rupert of debate."

The best answer, however, which he made to the attacks of the great agitator was not the retorts of debate, effective though these were, but the beneficial legislation he was instrumental in

passing. He introduced and carried the first national education act for Ireland, one result of which was the remarkable and to many almost incredible phenomenon of a board composed of Catholics, Episcopalians and Presbyterians harmoniously administering an efficient education scheme. He was also chiefly responsible for the Irish Church Temporalities Act, though the bill was not introduced into parliament until after he had quitted the Irish secretaryship for another office. By this measure two archbishoprics and eight bishoprics were abolished, and a remedy was provided for various abuses connected with the revenues of the church. As originally introduced, the bill contained a clause authorizing the appropriation of surplus revenues to non-ecclesiastical purposes. This had, however, been strongly opposed from the first by Stanley and several other members of the cabinet, and it was withdrawn by the government before the measure reached the Lords.

In 1833, just before the introduction of the Irish Church Temporalities Bill, Stanley had been promoted to be secretary for the colonies with a seat in the cabinet. In this position it fell to his lot to carry the emancipation of the slaves to a successful practical issue. The speech which he delivered on introducing the bill for freeing the slaves in the West Indies, on the 14th of May 1833, was one of the finest specimens of his eloquence.

The Irish Church question determined more than one turning-point in his political career. The most important occasion on which it did so was in 1834, when the proposal of the government to appropriate the surplus revenues of the church to educational purposes led to his secession from the cabinet, and, as it proved, his complete and final separation from the Whig party. In the former of these steps he had as his companions Sir James Graham, the earl of Ripon and the duke of Richmond. Soon after it occurred, O'Connell, amid the laughter of the House, described the secession in a couplet from Canning's *Loves of the Triangles*:—

> "Still down thy steep, romantic Ashbourne, glides
> The Derby dilly carrying six insides."

Stanley was not content with marking his disapproval by the simple act of withdrawing from the cabinet. He spoke against the bill to which he objected with a vehemence that showed the strength of his feeling in the matter, and against its authors with a bitterness that he himself is understood to have afterwards admitted to have been unseemly towards those who had so recently been his colleagues. The course followed by the government was "marked with all that timidity, that want of dexterity, which led to the failure of the unpractised shoplifter." His late colleagues were compared to "thimble-riggers at a country fair," and their plan was "petty larceny, for it had not the redeeming qualities of bold and open robbery."

In the end of 1834, Lord Stanley, as he was now styled by courtesy, his father having succeeded to the earldom in October, was invited by Sir Robert Peel to join the short-lived Conservative ministry which he formed after the resignation of Lord Melbourne. Though he declined the offer for reasons stated in a letter published in the Peel memoirs, he acted from that date with the Conservative party, and on its next accession to power, in 1841, he accepted the office of colonial secretary, which he had held under Lord Grey. His position and his temperament alike, however, made him a thoroughly independent supporter of any party to which he attached himself. When, therefore, the injury to health arising from the late hours in the Commons led him in 1844 to seek elevation to the Upper House in the right of his father's barony, Sir Robert Peel, in acceding to his request, had the satisfaction of at once freeing himself from the possible effects of his "candid friendship" in the House, and at the same time greatly strengthening the debating power on the Conservative side in the other. If the premier in taking this step had any presentiment of an approaching difference on a vital question, it was not long in being realized. When Sir Robert Peel accepted the policy of free trade in 1846, the breach between him and Lord Stanley was, as might have been anticipated from the antecedents of the latter, instant and irreparable. Lord Stanley at once asserted himself as the uncompromising opponent of that policy, and he became the recognized leader of the Protectionist party, having Lord George Bentinck and Disraeli for his lieutenants in the Commons. They did all that could be done in a case in which the logic of events was against them, though Protection was never to become more than their watchword.

It is one of the peculiarities of English politics, however, that a party may come into power because it is the only available one at the time, though it may have no chance of carrying the very principle to which it owes its organized existence. Such was the case when Lord Derby, who had succeeded to the earldom on the death of his father in June 1851, was called upon to form his first administration in February 1852. He was in a minority, but the circumstances were such that no other than a minority government was possible, and he resolved to take the only available means of strengthening his position by dissolving parliament and appealing to the country at the earliest opportunity. The appeal was made in autumn, but its result did not materially alter the position of parties. Parliament met in November, and by the middle of the following month the ministry had resigned in consequence of their defeat on Disraeli's budget. For the six following years, during Lord Aberdeen's "ministry of all the talents" and Lord Palmerston's premiership, Lord Derby remained at the head of the opposition, whose policy gradually became more generally Conservative and less distinctively Protectionist as the hopelessness of reversing the measures adopted in 1846 made itself apparent. In 1855 he was asked to form an administration after the resignation of Lord Aberdeen, but failing to obtain sufficient support, he declined the task. It was in somewhat more hopeful circumstances that, after the defeat of Lord Palmerston on the Conspiracy Bill in February 1858, he assumed for the second time the reins of government. Though he still could not count upon a working majority, there was a possibility of carrying on affairs without sustaining defeat, which was realized for a full session, owing chiefly to the dexterous management of Mr Disraeli in the Commons. The one rock ahead was the question of reform, on which the wishes of the country were being emphatically expressed, but it was not so pressing as to require to be immediately dealt with. During the session of 1858 the government contrived to pass two measures of very considerable importance, one a bill to remove Jewish disabilities, and the other a bill to transfer the government of India from the East India Company to the crown. Next year the question of parliamentary reform had to be faced, and, recognizing the necessity, the government introduced a bill at the opening of the session, which, in spite of, or rather in consequence of, its "fancy franchises," was rejected by the House, and, on a dissolution, rejected also by the country. A vote of no confidence having been passed in the new parliament on the 10th of June, Lord Derby at once resigned.

After resuming the leadership of the Opposition Lord Derby devoted much of the leisure the position afforded him to the classical studies that had always been congenial to him. It was his reputation for scholarship as well as his social position that had led in 1852 to his appointment to the chancellorship of the university of Oxford, in succession to the duke of Wellington; and perhaps a desire to justify the possession of the honour on the former ground had something to do with his essays in the field of authorship. His first venture was a poetical version of the ninth ode of the third book of Horace, which appeared in Lord Ravensworth's collection of translations of the *Odes*. In 1862 he printed and circulated in influential quarters a volume entitled *Translations of Poems Ancient and Modern*, with a very modest dedicatory letter to Lord Stanhope, and the words "Not published" on the title-page. It contained, besides versions of Latin, Italian, French and German poems, a translation of the first book of the *Iliad*. The reception of this volume was such as to encourage him to proceed with the task he had chosen as his *magnum opus*, the translation of the whole of the *Iliad*, which accordingly appeared in 1864.

During the seven years that elapsed between Lord Derby's second and third administrations an industrial crisis occurred in his native county, which brought out very conspicuously his public spirit and his philanthropy. The destitution in Lancashire

caused by the stoppage of the cotton-supply in consequence of the American Civil War, was so great as to threaten to overtax the benevolence of the country. That it did not do so was probably due to Lord Derby more than to any other single man. From the first he was the very life and soul of the movement for relief. His personal subscription, munificent though it was, represented the least part of his service. His noble speech at the meeting in Manchester in December 1862, where the movement was initiated, and his advice at the subsequent meetings of the committee, which he attended very regularly, were of the very highest value in stimulating and directing public sympathy. His relations with Lancashire had always been of the most cordial description, notwithstanding his early rejection by Preston; but it is not surprising that after the cotton famine period the cordiality passed into a warmer and deeper feeling, and that the name of Lord Derby was long cherished in most grateful remembrance by the factory operatives.

On the rejection of Earl Russell's Reform Bill in 1866, Lord Derby was for the third time entrusted with the formation of a cabinet. Like those he had previously formed it was destined to be short-lived, but it lived long enough to settle on a permanent basis the question that had proved fatal to its predecessor. The "education" of the party that had so long opposed all reform to the point of granting household suffrage was the work of another; but Lord Derby fully concurred in, if he was not the first to suggest, the statesmanlike policy by which the question was disposed of in such a way as to take it once for all out of the region of controversy and agitation. The passing of the Reform Bill was the main business of the session 1867. The chief debates were, of course, in the Commons, and Lord Derby's failing powers prevented him from taking any large share in those which took place in the Lords. His description of the measure as a "leap in the dark" was eagerly caught up, because it exactly represented the common opinion at the time,—the most experienced statesmen, while they admitted the granting of household suffrage to be a political necessity, being utterly unable to foresee what its effect might be on the constitution and government of the country.

Finding himself unable, from declining health, to encounter the fatigues of another session, Lord Derby resigned office early in 1868. The step he had taken was announced in both Houses on the evening of the 25th of February, and warm tributes of admiration and esteem were paid by the leaders of the two great parties. He yielded the entire leadership of the party as well as the premiership to Disraeli. His subsequent appearances in public were few and unimportant. It was noted as a consistent close to his political life that his last speech in the House of Lords should have been a denunciation of Gladstone's Irish Church Bill marked by much of his early fire and vehemence. A few months later, on the 23rd of October 1869, he died at Knowsley.

Sir Archibald Alison, writing of him when he was in the zenith of his powers, styles him "by the admission of all parties the most perfect orator of his day." Even higher was the opinion of Lord Aberdeen, who is reported by *The Times* to have said that no one of the giants he had listened to in his youth, Pitt, Fox, Burke or Sheridan, "as a speaker, is to be compared with our own Lord Derby, when Lord Derby is at his best." (W. B. S.)

EDWARD HENRY STANLEY, 15th earl of Derby (1826–1893), eldest son of the 14th earl, was educated at Rugby and Trinity College, Cambridge, where he took a high degree and became a member of the society known as the Apostles. In March 1848 he unsuccessfully contested the borough of Lancaster, and then made a long tour in the West Indies, Canada and the United States. During his absence he was elected member for King's Lynn, which he represented till October 1869, when he succeeded to the peerage. He took his place, as a matter of course, among the Conservatives, and delivered his maiden speech in May 1850 on the sugar duties. Just before, he had made a very brief tour in Jamaica and South America. In 1852 he went to India, and while travelling in that country he was appointed under-secretary for foreign affairs in his father's first administration. From the outset of his career he was known to be a most Liberal Conservative, and in 1855 Lord Palmerston offered him the post of colonial secretary. He was much tempted by the proposal, and hurried down to Knowsley to consult his father, who called out when he entered the room, "Hallo, Stanley! what brings you here?—Has Dizzy cut his throat, or are you going to be married?" When the object of his sudden appearance had been explained, the Conservative chief received the courteous suggestion of the prime minister with anything but favour, and the offer was declined. In his father's second administration Lord Stanley held, at first, the office of secretary for the colonies, but became president of the Board of Control on the resignation of Lord Ellenborough. He had the charge of the India Bill of 1858 in the House of Commons, became the first secretary of state for India, and left behind him in the India Office an excellent reputation as a man of business. After the revolution in Greece and the disappearance of King Otho, the people most earnestly desired to have Queen Victoria's second son, Prince Alfred, for their king. He declined the honour, and they then took up the idea that the next best thing they could do would be to elect some great and wealthy English noble, not concealing the hope that although they might have to offer him a Civil List he would decline to receive it. Lord Stanley was the prime favourite as an occupant of this bed of thorns, and it has been said that he was actually offered the crown. That, however, is not true; the offer was never formally made. After the fall of the Russell government in 1866 he became foreign secretary in his father's third administration. He compared his conduct in that great post to that of a man floating down a river and fending off from his vessel, as well as he could, the various obstacles it encountered. He thought that that should be the normal attitude of an English foreign minister, and probably under the circumstances of the years 1866–1868 it was the right one. He arranged the collective guarantee of the neutrality of Luxemburg in 1867, negotiated a convention about the "Alabama," which, however, was not ratified, and most wisely refused to take any part in the Cretan troubles. In 1874 he again became foreign secretary in Disraeli's government. He acquiesced in the purchase of the Suez Canal shares, a measure then considered dangerous by many people, but ultimately most successful; he accepted the Andrassy Note, but declined to accede to the Berlin Memorandum. His part in the later phases of the Russo-Turkish struggle has never been fully explained, for with equal wisdom and generosity he declined to gratify public curiosity at the cost of some of his colleagues. A later generation will know better than his contemporaries what were the precise developments of policy which obliged him to resign. He kept himself ready to explain in the House of Lords the course he had taken if those whom he had left challenged him to do so, but from that course they consistently refrained. Already in October 1879 it was clear enough that he had thrown in his lot with the Liberal party, but it was not till March 1880 that he publicly announced this change of allegiance. He did not at first take office in the second Gladstone government, but became secretary for the colonies in December 1882, holding this position till the fall of that government in the summer of 1885. In 1886 the old Liberal party was run on the rocks and went to pieces. Lord Derby became a Liberal Unionist, and took an active part in the general management of that party, leading it in the House of Lords till 1891, when Lord Hartington became duke of Devonshire. In 1892 he presided over the Labour Commission, but his health never recovered an attack of influenza which he had in 1891, and he died at Knowsley on the 21st of April 1893.

During a great part of Lord Derby's life he was deflected from his natural course by the accident of his position as the son of the leading Conservative statesman of the day. From first to last he was at heart a moderate Liberal. After making allowance, however, for this deflecting agency, it must be admitted that in the highest quality of the statesman, "aptness to be right," he was surpassed by none of his contemporaries, or—if by anybody—by Sir George Cornewall Lewis alone. He would have been more at home in a state of things which did not demand from its leading statesman great popular power; he had none of those "isms" and "prisms of fancy" which stood in such good stead

some of his rivals. He had another defect besides the want of popular power. He was so anxious to arrive at right conclusions that he sometimes turned and turned and turned a subject over till the time for action had passed. One of his best lieutenants said of him in a moment of impatience: "Lord Derby is like the God of Hegel: 'Er setzt sich, er verneint sich, er verneint seine Negation.'" His knowledge, acquired both from books and by the ear, was immense, and he took every opportunity of increasing it. He retained his old university habit of taking long walks with a congenial companion, even in London, and although he cared but little for what is commonly known as society—the society of crowded rooms and fragments of sentences—he very much liked conversation. During the many years in which he was a member of "The Club" he was one of its most assiduous frequenters, and his loss was acknowledged by a formal resolution. His talk was generally grave, but every now and then was lit up by dry humour. The late Lord Arthur Russell once said to him, after he had been buying some property in southern England: "So you still believe in land, Lord Derby." "Hang it," he replied, "a fellow must believe in something!" He did an immense deal of work outside politics. He was lord rector of the University of Glasgow from 1868 to 1871, and later held the same office in that of Edinburgh. From 1875 to 1893 he was president of the Royal Literary Fund, and attended most closely to his duties then. He succeeded Lord Granville as chancellor of the University of London in 1891, and remained in that position till his death. He lived much in Lancashire, managed his enormous estates with great skill, and did a great amount of work as a local magnate. He married in 1870 Maria Catharine, daughter of the 5th earl de la Warr, and widow of the 2nd marquess of Salisbury.

The earl left no children and he was succeeded as 16th earl by his brother Frederick Arthur Stanley (1841–1908), who had been made a peer as Baron Stanley of Preston in 1886. He was secretary of state for war and for the colonies and president of the board of trade; and was governor-general of Canada from 1888 to 1893. He died on the 14th of June 1908, when his eldest son, Edward George Villiers Stanley, became earl of Derby. As Lord Stanley the latter had been member of parliament for the West Houghton division of Lancashire from 1892 to 1906; he was financial secretary to the War Office from 1900 to 1903, and postmaster-general from 1903 to 1905.

The best account of the 15th Lord Derby is that which was prefixed by W. E. H. Lecky, who knew him very intimately, to the edition of his speeches outside parliament, published in 1894. (M. G. D.)

DERBY, a city of New Haven county, Connecticut, U.S.A., coextensive with the township of Derby, about 10 m. W. of New Haven, at the junction of the Housatonic and Naugatuck rivers. Pop. (1900) 7930 (2635 foreign-born); (1910) 8991. It is served by the New York, New Haven & Hartford railway, and by interurban electric railways. In Derby there are an opera house, owned by the city, and a public library. Across the Housatonic is the borough of Shelton (pop. 1900, 2837), which is closely related, socially and industrially, to Derby, the two having a joint board of trade. Adjoining Derby on the N. along the Naugatuck is Ansonia. Derby, Ansonia and Shelton form one of the most important manufacturing communities in the state; although their total population in 1900 (23,448) was only 2·9 % of the state's population, the product of their manufactories was 7·4 % of the total manufactured product of Connecticut. Among the manufactures of Derby are pianos and organs, woollen goods, pins, keys, dress stays, combs, typewriters, corsets, hosiery, guns and ammunition, and foundry and machine-hop products. Derby was settled in 1642 as an Indian trading post under the name Paugasset, and received its present name in 1675. The date of organization of the township is unknown. Ansonia was formed from a part of Derby in 1889. In 1893 the borough of Birmingham, on the opposite side of the Naugatuck, was annexed to Derby, and Derby was chartered as a city. In the 18th century Derby was the centre of a thriving commerce with the West Indies. Derby is the birthplace of David Humphreys (1752–1818), a soldier, diplomatist and writer, General Washington's aide and military secretary from 1780 until the end of the War of Independence, the first minister of the United States to Portugal (1790–1797) and minister to Spain in 1797–1802, and one of the "Hartford Wits."

See Samuel Orcutt and Ambrose Beardsley, *History of the Old Town of Derby* (Springfield, 1880); and the *Town Records of Derby from 1655 to 1710* (Derby, 1901).

DERBY, a municipal, county and parliamentary borough, and the county town of Derbyshire, England, 128¼ m. N.N.W. of London by the Midland railway; it is also served by the Great Northern railway. Pop. (1891) 94,146; (1901) 114,848. Occupying a position almost in the centre of England, the town is situated chiefly on the western bank of the river Derwent, on an undulating site encircled with gentle eminences, from which flow the Markeaton and other brooks. In the second half of the 19th century the prosperity of the town was enhanced by the establishment of the head offices and principal workshops of the Midland Railway Company. Derby possesses several handsome public buildings, including the town hall, a spacious range of buildings erected for the postal and inland revenue offices, the county hall, corn exchange and market hall. Among churches may be mentioned St Peter's, a fine building principally of Perpendicular date but with earlier portions; St Alkmund's with its lofty spire, Decorated in style; St Andrew's, in the same style, by Sir G. G. Scott; and All Saints', which contains a beautiful choir-screen, good stained glass and monuments by L. F. Roubiliac, Sir Francis Chantrey and others. The body of this church is in classic style (1725), but the tower was built 1509–1527, and is one of the finest in the midland counties, built in three tiers, and crowned with battlements and pinnacles, which give it a total height of 210 ft. The Roman Catholic church of St Mary is one of the best examples of the work of A. W. Pugin. The Derby grammar school, one of the most ancient in England, was placed in 1160 under the administration of the chapter of Darley Abbey, which lay a little north of Derby. It occupies St Helen's House, once the town residence of the Strutt family, and has been enlarged in modern times, accommodating about 160 boys. The Derby municipal technical college is administered by the corporation. Other institutions include schools of science and art, public library, museum and art gallery, the Devonshire almshouses, a remodelled foundation inaugurated by Elizabeth, countess of Shrewsbury, in the 16th century, and the town and county infirmary. The free library and museum buildings, together with a recreation ground, were gifts to the town from M. T. Bass, M.P. (d. 1884), while an arboretum of seventeen acres was presented to the town by Joseph Strutt in 1840.

Derby has been long celebrated for its porcelain, which rivalled that of Saxony and France. This manufacture was introduced about 1750, and although for a time partially abandoned, it has been revived. There are also spar works where the fluor-spar, or Blue John, is wrought into a variety of useful and ornamental articles. The manufacture of silk, hosiery, lace and cotton formerly employed a large portion of the population, and there are still numerous silk mills and elastic web works. Silk "throwing" or spinning was introduced into England in 1717 by John Lombe, who found out the secrets of the craft when visiting Piedmont, and set up machinery in Derby. Other industries include the manufacture of paint, shot, white and red lead and varnish; and there are sawmills and tanneries. The manufacture of hosiery profited greatly by the inventions of Jedediah Strutt about 1750. In the northern suburb of Littlechester, there are chemical and steam boiler works. The Midland railway works employ a large number of hands. Derby is a suffragan bishopric in the diocese of Southwell. The parliamentary borough returns two members. The town is governed by a mayor, sixteen aldermen and forty-two councillors. Area, 3449 acres.

Littlechester, as its name indicates, was the site of a Roman fort or village; the site is in great part built over and the remains practically effaced. Derby was known in the time of the heptarchy as Northworthig, and did not receive the name of

Deoraby or Derby until after it was given up to the Danes by the treaty of Wedmore and had become one of their five boroughs, probably ruled in the ordinary way by an earl with twelve "lawmen" under him. Being won back among the sweeping conquests of Æthelflæd, lady of the Mercians, in 917, it prospered during the 10th century, and by the reign of Edward the Confessor there were 243 burgesses in Derby. However, by 1086 this number had decreased to 100, while 103 "manses" which used to be assessed were waste. In spite of this the amount rendered by the town to the lord had increased from £24 to £30. The first extant charter granted to Derby is dated 1206 and is a grant of all those privileges which the burgesses of Nottingham had in the time of Henry I. and Henry II., which included freedom from toll, a gild merchant, power to elect a provost at their will, and the privilege of holding the town at the ancient farm with an increase of £10 yearly. The charter also provides that no one shall dye cloth within ten leagues of Derby except in the borough. A second charter, granted by Henry III. in 1229, limits the power of electing a provost by requiring that he shall be removed if he be displeasing to the king. Henry III. also granted the burgesses two other charters, one in 1225 confirming their privileges and granting that the *comitatus* of Derby should in future be held on Thursdays in the borough, the other in 1260 granting that no Jew should be allowed to live in the town. In 1337 Edward III. on the petition of the burgesses granted that they might have two bailiffs instead of one. Derby was incorporated by James I. in 1611 under the name of the bailiffs and burgesses of Derby, but Charles I. in 1637 appointed a mayor, nine aldermen, fourteen brethren and fourteen capital burgesses. In 1680 the burgesses were obliged to resign their charters, and received a new one, which did not, however, alter the government of the town. Derby has been represented in parliament by two members since 1295. In the rebellion of 1745 the young Pretender marched with his army as far south as Derby, where the council was held which decided that he should return to Scotland instead of going on to London.

Among early works on Derby are W. Hutton, *History of Derby* (London, 1791); R. Simpson, *History and Antiquities of Derby* (Derby, 1826).

DERBYSHIRE, a north midland county of England, bounded N. and N.E. by Yorkshire, E. by Nottinghamshire, S.E. and S. by Leicestershire, S. and S.W. by Staffordshire, and W. and N.W. by Cheshire. The area is 1029·5 sq. m. The physical aspect is much diversified. The extreme south of the county is lacking in picturesqueness, being for the most part level, with occasional slight undulations. The Peak District of the north, on the other hand, though inferior in grandeur to the mountainous Lake District, presents some of the finest hill scenery in England, deriving a special beauty from the richly wooded glens and valleys, such as those of Castleton, Glossop, Dovedale and Millersdale. The character of the landscape ranges from the wild moorland of the Cheshire borders or the grey rocks of the Peak, to the park lands and woods of the Chatsworth district. Some of the woods are noted for their fine oaks, those at Kedleston, 3 m. from Derby, ranking among the largest and oldest in the kingdom. From the northern hills the streams of the county radiate. Those of the north-west belong to the Mersey, and those of the north-east to the Don, but all the others to the Trent, which, like the Don, falls into the Humber. The principal river is the Trent, which, rising in the Staffordshire moorlands, intersects the southern part of Derbyshire, and forms part of its boundary with Leicestershire. After the Trent the most important river is the Derwent, one of its tributaries, which, taking its rise in the lofty ridges of the High Peak, flows southward through a beautiful valley, receiving a number of minor streams in its course, including the Wye, which, rising near Buxton, traverses the fine Millersdale and Monsal Dale. The other principal rivers are the following: The Dane rises at the junction of the three counties, Staffordshire, Cheshire and Derbyshire. The Goyt has its source a little farther north, at the base of the same hill, and, taking a N.N.E. direction, divides Derbyshire from Cheshire, and falls into the Mersey. The Dove rises on the southern slope, and flows as the boundary stream between Derbyshire and Staffordshire for nearly its entire course. It receives several feeders, and falls into the Trent near Repton. The Erewash is the boundary stream between Nottinghamshire and Derbyshire. The Rother rises about Baslow, and flows into Yorkshire, with a northerly course, joining the Don. Besides the attractions of its scenery Derbyshire possesses, in Buxton, Matlock and Bakewell, three health resorts in much favour on account of their medicinal springs.

The whole northward extension of the county is occupied by the plateau of the Peak and other plateau-like summits, the highest of which are of almost exactly similar elevation. Thus in the extreme north Bleaklow Hill reaches 2060 ft., while southward from this point along the axis of main elevation are found Shelf Moss (2046 ft.), and Kinder Scout and other summits of the Peak itself, ranging up to 2088 ft. This plateau-mass is demarcated on the north and west by the vales of the Etherow and Goyt, by the valley of the Derwent on the east, and in part by that of its tributary the Noe on the south. The flanks of the plateau are deeply scored by abrupt ravines, often known as "cloughs" (an Anglo-Saxon word, *cloh*) watered by streams which sometimes descend over precipitous ledges in picturesque falls, such as the Kinder Downfall, formed by the brook of that name which rises on Kinder Scout. The most picturesque cloughs are found on the south, descending to Edale, and on the west. Edale is the upper part of the Noe valley, and the narrow gorge at its head is exceedingly beautiful, as is the more gentle scenery of the Vale of Hope, the lower part of the valley. In a branch vale is situated Castleton (*q.v.*), with the ruined Peak Castle or Castle of the Peak, and the Peak Cavern, Blue John Mine and other caves. The upper Derwent valley, or Derwent Dale, is narrow and well wooded. In it, near the village of Derwent Chapel, is Derwent Hall, a fine old mansion formerly a seat of the Newdigate family. On Derwent Edge, above the village, are various peculiar rock formations, known by such names as the Salt-cellar. Ashopton, another village lower down the dale, is a favourite centre, and here the main valley is joined by Ashop Dale, a bold defile in its upper part, penetrating the heart of the Peak.

The well-known high road crossing the plateau from east to west, between the lower Derwent valley, Bakewell, Buxton and Macclesfield, shows the various types of scenery characteristic of the limestone hill-country of Derbyshire south of the Peak itself. The lower Derwent valley, about Chatsworth, Rowsley, Darley and Matlock, is open, fertile and well wooded. The road leads up the tributary valley of the Wye, which after Bakewell quickly narrows, and in successive portions is known as Monsal Dale, Millersdale (which the main road does not touch), Chee Dale and Wye Dale. On the flanks of these beautiful dales bold cliffs and bastions of limestone stand out among rich woods. Near the mouth of the valley, about Stanton, the fantastic effects of weathering on the limestone are especially well seen, as in Rowtor Rocks and Robin Hood's Stride, and in the same locality are a remarkable number of tumuli and other early remains, and the Hermitage, a cave containing sacred carvings. From Buxton the road ascends over the high moors, here open and grassy in contrast to the heather of the Peak, and shortly after crossing the county boundary, reaches the head of the pass well known by the name of an inn, the Cat and Fiddle, at its highest point, 1690 ft.

South of Buxton the elevations along the main axis decrease, thus Axe Edge reaches 1600 ft., and this height is nowhere exceeded as the hills sink to the plain valley of the Trent. The dales and ravines which ramify among the limestone heights are characteristic and beautiful, and the valley of the Dove (*q.v.*) or Dovedale, on the border with Staffordshire, is as famous as any of the northern dales. Swallow-holes or waterworn caverns are common in many parts of the limestone region. The hills east of the Derwent are nowhere so high as those to the west—Margley Hill reaches 1793 ft., Howden Edge 1787 ft. and Derwent Moors 1505 ft. The plateau type is maintained. The valley of the Derwent provides the most attractive scenery in

the southern part of the county, from Matlock southward by Heage, Belper and Duffield to Derby.

Geology.—Five well-contrasted types of scenery in Derbyshire are clearly traceable to as many varieties of rock; the bleak dry uplands of the north and east, with deep-cut ravines and swift clear streams, are due to the great mass of Mountain Limestone; round the limestone boundary are the valleys with soft outlines in the Pendleside Shales; these are succeeded by the rugged moorlands, covered with heather and peat, which are due to the Millstone Grit series; eastward lies the Derbyshire Coalfield with its gently moulded grass-covered hills; southward is the more level tract of red Triassic rocks. The principal structural feature is the broad anticline, its axis running north and south, which has brought up the Carboniferous Limestone; this uplifted region is the southern extremity of the Pennine Range. The Carboniferous or "Mountain" Limestone is the oldest formation in the county; its thickness is not known, but it is certainly over 2000 ft.; it is well exposed in the numerous narrow gorges cut by the Derwent and its tributaries and by the Dove on the Staffordshire border. Ashwood Dale, Chee Dale, Millersdale, Monsal Dale and the valley at Matlock are all flanked by abrupt sides of this rock. It is usually a pale, thick-bedded rock, sometimes blue and occasionally, as at Ashford, black. In some places, *e.g.* Thorpe Cloud, it is highly fossiliferous, but it is usually somewhat barren except for abundant crinoids and smaller organisms. It is polished in large slabs at Ashford, where crinoidal, black and "rosewood" marbles are produced. Volcanic rocks, locally called "Toadstone," are represented in the limestones by intrusive sills and flows of dolerite and by necks of agglomerate, notably near Tideswell, Millersdale and Matlock. Beds and nodules of chert are abundant in the upper parts of the limestone; at Bakewell it is quarried for use in the Potteries. At some points the limestone has been dolomitized; near Bonsall it has been converted into a granular silicified rock. A series of black shales with nodular limestones, the Pendleside series, rests upon the Mountain Limestone on the east, south and north-west; much of the upper course of the Derwent has been cut through these soft beds. Mam Tor, or the Shivering Mountain, is made of these shales. Next in upward sequence is a thick mass of sandstones, grits and shales—the Millstone Grit series. On the west side these extend from Blacklow Hill to Axe Edge; on the east, from Derwent Edge to near Derby; outlying masses form the rough moorland on Kinder Scout and the picturesque tors near Stanton-by-Youlgreave. A small patch of Millstone Grit and Limestone occurs in the south of the county about Melbourne and Ticknall. The Coal Measures repose upon the Millstone Grit; the largest area of these rocks lies on the east, where they are conterminous with the coalfields of Yorkshire and Nottingham. A small tract, part of the Leicestershire coalfield, lies in the south-east corner, and in the north-west corner a portion of the Lancashire coalfield appears about New Mills and Whaley Bridge. They yield valuable coals, clays, marls and ganister. East of Bolsover, the Coal Measures are covered unconformably by the Permian breccias and magnesian limestone. Flanking the hills between Ashbourne and Quarndon are red beds of Bunter marl, sandstone and conglomerate; they also appear at Morley, east of the Derwent, and again round the small southern coalfield. Most of the southern part of the county is occupied by Keuper marls and sandstones, the latter yield good building stone; and at Chellaston the gypsum beds in the former are excavated on a large scale. Much of the Triassic area is covered superficially by glacial drift and alluvium of the Trent. Local boulders as well as northern erratics are found in the valley of the Derwent. The bones of Pleistocene mammals, the rhinoceros, mammoth, bison, hyaena, &c., have been found at numerous places, often in caves and fissures in the limestones, *e.g.* at Castleton, Wirksworth and Creswell. At Doveholes the Pleiocene *Mastodon* has been reported. Galena and other lead ores are abundant in veins in the limestone, but they are now only worked on a large scale at Mill Close, near Winster; calamine, zinc, blende, barytes, calcite and fluor-spar are common. A peculiar variety of the last named, called "Blue John," is found only near Castleton; at the same place occurs the remarkable elastic bitumen, "elaterite." Limestone is quarried at Buxton, Millersdale and Matlock for lime, fluxing and chemical purposes. Good sandstone is obtained from the Millstone Grit at Stancliffe, Tansley and Whatstandwell. Calcareous tufa or travertine occurs in the valley of Matlock and elsewhere, and in some places is still being deposited by springs. Large pits containing deposits of white sand, clay and pebbles are found in the limestone at Longcliff, Newhaven and Carsington.

Climate.—From the elevation which it attains in its northern division the county is colder and is rainier than other midland counties. Even in summer cold and thick fogs are often seen hanging over the rivers, and clinging to the lower parts of the hills, and hoar-frosts are by no means unknown even in June and July. The winters in the uplands are generally severe, and the rainfall heavy. At Buxton, at an elevation of about 1000 ft., the mean temperature in January is 34·9° F., and in July 57·5°, the mean annual being 45·4°. These conditions contrast with those at Derby, in the southern lowland, where the figures are respectively 37·5°, 61·2° and 48·8°, while intermediate conditions are found at Belper, 9 m. higher up the Derwent valley, where the figures are 36·3°, 59·9° and 47·3°. The contrasts shown by the mean annual rainfall are similarly marked. Thus at Woodhead, lying high in the extreme north, it is 52·03 in., at Buxton 49·33 in., at Matlock, in the middle part of the Derwent valley, 35·2 in., and at Derby 24·35 in.

Agriculture.—A little over seven-tenths of the total area of the county is under cultivation. Among the higher altitudes of north Derbyshire, where the soil is poor and the climate harsh, grain is unable to flourish, while even in the more sheltered parts of this region the harvest is usually belated. In such districts sheep farming is chiefly practised, and there is a considerable area of heath pasture. Farther south, heavy crops of wheat, turnips and other cereals and green crops are not uncommon, while barley is cultivated about Repton and Gresley, and also in the east of the county, in order to supply the Burton breweries. A large part of the Trent valley is under permanent pasture, being devoted to cattle-feeding and dairy-farming. This industry has prospered greatly, and the area of permanent pasture encroaches continually upon that of arable land. Derbyshire cheeses are exported or sent to London in considerable quantities; and cheese fairs are held in various parts of the county, as at Ashbourne and Derby. A feature of the upland districts is the total absence of hedges, and the substitution of limestone walls, put together without any mortar or cement.

Other Industries.—The manufactures of Derbyshire are both numerous and important, embracing silks, cotton hosiery, iron, woollen manufactures, lace, elastic web and brewing. For many of these this county has long been famous, especially for that of silk, which is carried on to a large extent in Derby, as well as in Belper and Duffield. Derby is also celebrated for its china, and silk-throwing is the principal industry of the town. Elastic web weaving by power looms is carried on to a great extent, and the manufacture of lace and net curtains, gimp trimmings, braids and cords. In the county town and neighbourhood are several important chemical and colour works; and in various parts of the county, as at Belper, Cromford, Matlock, Tutbury, are cotton-spinning mills, as well as hosiery and tape manufactories. The principal works of the Midland Railway Company are at Derby. The principal mineral is coal. Ironstone is not extensively wrought, but, on account of the abundant supply of coal, large quantities are imported for smelting purposes. There are smelting furnaces in several districts, as at Alfreton, Chesterfield, Derby, Ilkeston. Besides lead, gypsum and zinc are raised, to a small extent; and for the quarrying of limestone Derbyshire is one of the principal English counties. The east and the extreme south-west parts are the principal industrial districts.

Communications.—The chief railway serving the county is the Midland, the south, east and north being served by its main line and branches. In the north-east and north the Great Central system touches the county; in the west the North Staffordshire and a branch of the London & North-Western; while a branch of the Great Northern serves Derby and other places in the south. The Trent & Mersey canal crosses the southern part of the county, and there is a branch canal (the Derby) connecting Derby with this and with the Erewash canal, which runs north from the Trent up the Erewash valley. From it there is a little-used branch (the Cromford canal) to Matlock.

Population and Administration.—The area of the ancient county is 658,885 acres, with a population in 1891 of 528,033, and 1901 of 620,322. The area of the administrative county is 652,272 acres. The county contains six hundreds. The municipal boroughs are Chesterfield (pop. 27,185), Derby, a county borough and the county town (114,848), Glossop (21,526), Ilkeston (25,384). The other urban districts are Alfreton (17,505), Alvaston and Boulton (1279), Ashbourne (4039), Bakewell (2850), Baslow and Bubnell (797), Belper (10,934), Bolsover (6844) Bonsall (1360), Brampton and Walton (2698), Buxton (10,181), Clay Cross (8358), Dronfield (3809), Fairfield (2969), Heage (2889), Heanor (16,249), Long Eaton (13,045), Matlock (5979), Matlock Bath and Scarthin Nick (1819), Newbold and Dunston (5986),

New Mills (7773), North Darley (2756), Ripley (10,111), South Darley (788), Swadlincote (18,014), Whittington (9416), Wirksworth (3807). Among other towns may be mentioned Ashover (2426), Barlborough (2056), Chapel-en-le-Frith (4626), Clowne (3896), Crich (3063), Killamarsh (3644), Staveley (11,420), Whitwell (3380). The county is in the Midland circuit, and assizes are held at Derby. It has one court of quarter sessions and is divided into fifteen petty sessional divisions. The boroughs of Derby, Chesterfield and Glossop have separate commissions of the peace, and that of Derby has also a separate court of quarter sessions. The total number of civil parishes is 314. The county is mainly in the diocese of Southwell, with small portions in the dioceses of Peterborough and Lichfield, and contains 255 ecclesiastical parishes or districts. The parliamentary divisions of the county are High Peak, North-Eastern, Chesterfield, Mid, Ilkeston, Southern and Western, each returning one member, while the parliamentary borough of Derby returns two members.

History.—The earliest English settlements in the district which is now Derbyshire were those of the West Angles, who in the course of their northern conquests in the 6th century pushed their way up the valleys of the Derwent and the Dove, where they became known as the Pecsaetan. Later the district formed the northern division of Mercia, and in 848 the Mercian witenagemot assembled at Repton. In the 9th century the district suffered frequently from the ravages of the Danes, who in 874 wintered at Repton and destroyed its famous monastery, the burial-place of the kings of Mercia. Derby under Guthrum was one of the five Danish burghs, but in 917 was recovered by Æthelflæd. In 924 Edward the Elder fortified Bakewell, and in 942 Edmund regained Derby, which had fallen under the Danish yoke. Barrows of the Saxon period are numerous in Wirksworth hundred and the Bakewell district, among the most remarkable being White-low near Winster and Bower's-low near Tissington. There are Saxon cemeteries at Stapenhill and Foremark Hall.

Derbyshire probably originated as a shire in the time of Æthelstan, but for long it maintained a very close connexion with Nottinghamshire, and the Domesday Survey gives a list of local customs affecting the two counties alike. The two shire-courts sat together for the Domesday Inquest, and the counties were united under one sheriff until the time of Elizabeth. The villages of Appleby, Oakthorpe, Donisthorpe, Stretton-en-le-Field, Willesley, Chilcote and Measham were reckoned as part of Derbyshire in 1086, although separated from it by the Leicestershire parishes of Over and Nether Seat.

The early divisions of the county were known as wapentakes, five being mentioned in Domesday, while 13th-century documents mention seven wapentakes, corresponding with the six present hundreds, except that Repton and Gresley were then reckoned as separate divisions. In the 14th century the divisions were more frequently described as hundreds, and Wirksworth alone retained the designation wapentake until modern times. Ecclesiastically the county constituted an archdeaconry in the diocese of Lichfield, comprising the six deaneries of Derby, Ashbourne, High Peak, Castillar, Chesterfield and Repington. In 1884 it was transferred to the newly formed diocese of Southwell. The assizes for Nottinghamshire and Derbyshire were held at Nottingham until the reign of Henry III., when they were held alternately at Nottingham and Derby until 1569, after which the Derbyshire assizes were held at Derby. The court of the Honour of Peverel, held at Basford in Nottinghamshire, which formerly exercised jurisdiction in the hundreds of Scarsdale, the Peak and Wirksworth, was abolished in 1849. The miners of Derbyshire formed an independent community under the jurisdiction of a steward and barmasters, who held two Barmote courts (*q.v.*) every year. The forests of Peak and Duffield had their separate courts and officers, the justice seat of the former being in an extra-parochial part at equal distances from Castleton, Tideswell and Bowden, while the pleas of Duffield Forest were held at Tutbury. Both were disafforested in the 17th century.

The greatest landholder in Derbyshire at the time of the Domesday Survey was Henry de Ferrers, who owned almost the whole of the modern hundred of Appletree. The Ferrers estates were forfeited by Robert, earl of Derby, in the reign of Henry III. Another great Domesday landholder was William Peverel, the historic founder of Peak Castle, whose vast possessions were known as the Honour of Peverel. In 1155 the younger Peverel was disinherited for poisoning the earl of Chester, and his estates forfeited to the crown. Few Englishmen retained estates of any importance after the Conquest, but one, Elfin, an under-tenant of Henry de Ferrers, not only held a considerable property but was the ancestor of the Derbyshire family of Brailsford. The families of Shirley and Gresley can also boast an unbroken descent from Domesday tenants.

During the rebellion of Prince Henry against Henry II. the castles of Tutbury and Duffield were held against the king, and in the civil wars of John's reign Bolsover and Peak Castles were garrisoned by the rebellious barons. In the Barons' War of the reign of Henry III. the earl of Derby was active in stirring up feeling in the county against the king, and in 1266 assembled a considerable force, which was defeated by the king's party at Chesterfield. At the time of the Wars of the Roses discontent was rife in Derbyshire, and riots broke out in 1443, but the county did not lend active support to either party. On the outbreak of the Civil War of the 17th century, the county at first inclined to support the king, who received an enthusiastic reception when he visited Derby in 1642, but by the close of 1643 Sir John Gell of Hopton had secured almost the whole county for the parliament. Derby, however, was always royalist in sympathy, and did not finally surrender till 1646; in 1659 it rebelled against Richard Cromwell, and in 1745 entertained the young Pretender.

Derbyshire has always been mainly a mining and manufacturing county, though the rich land in the south formerly produced large quantities of corn. The lead mines were worked by the Romans, and the Domesday Survey mentions lead mines at Wirksworth, Matlock, Bakewell, Ashford and Crich. Iron has also been produced in Derbyshire from an early date, and coal mines were worked at Norton and Alfreton in the beginning of the 14th century. The woollen industry flourished in the county before the reign of John, when an exclusive privilege of dyeing cloth was conceded to the burgesses of Derby. Thomas Fuller writing in 1662 mentions lead, malt and ale as the chief products of the county, and the Buxton waters were already famous in his day. The 18th century saw the rise of numerous manufactures. In 1718 Sir Thomas and John Lombe set up an improved silk-throwing machine at Derby, and in 1758 Jedediah Strutt introduced a machine for making ribbed stockings, which became famous as the "Derby rib." In 1771 Sir Richard Arkwright set up one of his first cotton mills in Cromford, and in 1787 there were twenty-two cotton mills in the county. The Derby porcelain or china manufactory was started about 1750.

From 1295 until the Reform Act of 1832 the county and town of Derby each returned two members to parliament. From this latter date the county returned four members in two divisions until the act of 1868, under which it returned six members for three divisions.

Antiquities.—Monastic remains are scanty, but there are interesting portions of a priory incorporated with the school buildings at Repton. The village church of Beauchief Abbey, near Dronfield, is a remnant of an abbey founded *c.* 1175 by Robert Fitzranulf. It has a stately transitional Norman tower, and three fine Norman arches. Dale Abbey, near Derby, was founded early in the 13th century for the Premonstratensian order. The ruins are scanty, but the east window is preserved, and the present church incorporates remains of the ancient rest-house for pilgrims. The church has a peculiar music gallery, entered from without. The abbey church contained famous stained glass, and some of this is preserved in the neighbouring church at Morley. Derbyshire is rich in ecclesiastical architecture as a whole. The churches are generally of various styles. The chancel of the church at Repton is assigned to the second half of the 10th century, though subsequently altered, and the crypt beneath is supposed to be earlier still; its roof is supported by

four round pillars, and it is approached by two stairways. Other remains of pre-Conquest date are the chancel arches in the churches of Marston Montgomery and of Sawley; and the curiously carved font in Wilne church is attributed to the same period. Examples of Norman work are frequent in doorways, as in the churches of Allestree and Willington near Repton, while a fine tympanum is preserved in the modern church of Findern. There is a triple-recessed doorway, with arcade above, in the west end of Bakewell church, and there is another fine west doorway in Melbourne church, a building principally of the late Norman period, with central and small western towers. In restoring this church curious mural paintings were discovered. At Steetley, near Worksop, is a small Norman chapel, with apse, restored from a ruinous condition; Youlgrave church, a building of much general interest, has Norman nave pillars and a fine font of the same period, and Normanton church has a peculiar Norman corbel table. The Early English style is on the whole less well exemplified in the county, but Ashbourne church, with its central tower and lofty spire, contains beautiful details of this period, notably the lancet windows in the Cockayne chapel.

The parish churches of Dronfield, Hathersage (with some notable stained glass), Sandiacre and Tideswell exemplify the Decorated period; the last is a particularly stately and beautiful building, with a lofty and ornate western tower and some good early brasses. The churches of Dethic, Wirksworth and Chesterfield are typical of the Perpendicular period; that of Wirksworth contains noteworthy memorial chapels, monuments and brasses, and that of Chesterfield is celebrated for its crooked spire.

The remains of castles are few; the ancient Bolsover Castle is replaced by a castellated mansion of the 17th century; of the Norman Peak Castle near Castleton little is left; of Codnor Castle in the Erewash valley there are picturesque ruins of the 13th century. Among ancient mansions Derbyshire possesses one of the most famous in England in Haddon Hall, of the 15th century. Wingfield manor house is a ruin dating from the same century. Hardwick Hall is a very perfect example of Elizabethan building; ruins of the old Tudor hall stand near by. Other Elizabethan examples are Barlborough and Tissington Halls.

The village of Tissington is noted for the maintenance of an old custom, that of "well-dressing." On the Thursday before Easter a special church service is celebrated, and the wells are beautifully ornamented with flowers, prayers being offered at each. The ceremony has been revived also in several other Derbyshire villages.

See Davies, *New Historical and Descriptive View of Derbyshire* (Belper, 1811); D. Lysons, *Magna Britannia*, vol. v. (London, 1817); Maunder, *Derbyshire Miners' Glossary* (Bakewell, 1824); R. Simpson, *Collection of Fragments illustrative of the History of Derbyshire* (1826); S. Glover, *History and Gazetteer of the County of Derby*, ed. T. Noble, part 1 of vols. i. and ii. (Derby, 1831–1833); T. Bateman, *Vestiges of the Antiquities of Derbyshire* (London, 1848); L. Jewitt, *Ballads and Songs of Derbyshire* (London, 1867); J. C. Cox, *Notes on the Churches of Derbyshire* (Chester, 1875), and *Three Centuries of Derbyshire Annals* (2 vols., London, 1890); R. N. Worth, *Derby*, in "Popular County Histories" (London, 1886); J. P. Yeatman, *Feudal History of the County of Derby* (3 vols., London, 1886–1895); *Victoria County History, Derbyshire*. See also *Notts and Derbyshire Notes and Queries*.

DEREHAM (properly EAST DEREHAM), a market town in the Mid parliamentary division of Norfolk, England, 122 m. N.N.E. from London by the Great Eastern railway. Pop. of urban district (1901) 5545. The church of St Nicholas is a cruciform Perpendicular structure with a beautiful central tower, and some portions of earlier date. It contains a monument to William Cowper, who came to live here in 1796, and the Congregational chapel stands on the site of the house where the poet spent his last days. Dereham is an important agricultural centre with works for the manufacture of agricultural implements, iron foundries and a malting industry.

DERELICT (from Lat. *derelinquere*, to forsake), in law, property thrown away or abandoned by the owner in such a manner as to indicate that he intends to make no further claim to it. The word is used more particularly with respect to property abandoned at sea (see WRECK), but it is also applied in other senses; for example, land gained from the sea by receding of the water is termed *dereliction*. Land gained gradually and slowly by dereliction belongs to the owner of the adjoining land, but in the case of sudden or considerable dereliction the land belongs to the Crown. This technical use of the term "dereliction" is to be distinguished from the more general modern sense, dereliction or abandonment of duty, which implies a culpable failure or neglect in moral or legal obligation.

DERENBOURG, JOSEPH (1811–1895), Franco-German orientalist. He was a considerable force in the educational revival of Jewish education in France. He made great contributions to the knowledge of Saadia, and planned a complete edition of Saadia's works in Arabic and French. A large part of this work appeared during his lifetime. He also wrote an *Essai sur l'histoire et la géographie de la Palestine* (Paris, 1867). This was an original contribution to the history of the Jews and Judaism in the time of Christ, and has been much used by later writers on the subject (*e.g.* by Schürer). He also published in collaboration with his son Hartwig, *Opuscules et traités d'Abou-'l-Walîd* (with translation, 1880); *Deux Versions hébraïques du livre de Kalilâh et Dimnah* (1881), and a Latin translation of the same story under the title *Joannis de Capua directorium vitae humanae* (1889); *Commentaire de Maimonide sur la Mischnah Seder Tohorot* (Berlin, 1886–1891); and a second edition of S. de Sacy's *Séances de Hariri*. He died on the 29th of July 1895, at Ems.

His son, HARTWIG DERENBOURG (1844–1908), was born in Paris on the 17th of June 1844. He was educated at Göttingen and Leipzig. Subsequently he studied Arabic at the École des Langues Orientales. In 1879 he was appointed professor of Arabic, and in 1886 professor of Mahommedan Religion, at the École des Hautes Études in Paris. He collaborated with his father in the great edition of Saadia and the edition of Abu-'l-Walîd, and also produced a number of important editions of other Arabic writers. Among these are *Le Dîwân de Nâbiqa Dhobyânî*; *Le Livre de Sibawaihi* (2 vols., Paris, 1881–1889); *Chrestomathie élémentaire de l'arabe littéral* (in collaboration with Spiro, 1885; 2nd ed., 1892); *Ousâma ibn Mounkidh, un émir syrien* (1889); *Ousâma ibn Mounkidh, préface du livre du bâton* (with trans., 1887); *Al-Fâkhrî* (1895); *Oumâra du Gémen* (1897), a catalogue of Arabic MSS. in the Escorial (vol. i., 1884).

DERG, LOUGH, a lake of Ireland, on the boundary of the counties Galway, Clare and Tipperary. It is an expansion of the Shannon, being the lowest lake on that river, and is 23 m. long and generally from 1 to 3 m. broad. It lies where the Shannon leaves the central plain of Ireland and flows between the hills which border the plain. While the northerly shores of the lake, therefore, are flat, the southern are steep and picturesque, being backed by the Slieve Aughty, Slieve Bernagh and Arra Mountains. Ruined churches and fortresses are numerous on the eastern shore, and on Iniscaltra Island are a round tower and remains of five churches.

Another LOUGH DERG, near Pettigo in Donegal, though small, is famous as the traditional scene of St Patrick's purgatory. In the middle ages its pilgrimages had a European reputation, and they are still observed annually by many of the Irish from June 1 to August 15. The hospice, chapels, &c., are on Station Island, and there is a ruined monastery on Saints' Island.

DERHAM, WILLIAM (1657–1735), English divine, was born at Stoulton, near Worcester, on the 26th of November 1657. He was educated at Blockley, in his native county, and at Trinity College, Oxford. In 1682 he became vicar of Wargrave, in Berkshire; and in 1689 he was preferred to the living of Upminster, in Essex. In 1696 he published his *Artificial Clockmaker*, which went through several editions. The best known of his subsequent works are *Physico-Theology*, published in 1713; *Astro-Theology*, 1714; and *Christo-Theology*, 1730. The first two of these books were teleological arguments for the being and attributes of God, and were used by Paley nearly a century later. In 1702 Derham

was elected fellow of the Royal Society, and in 1716 was made a canon of Windsor. He was Boyle lecturer in 1711–1712. His last work, entitled *A Defence of the Church's Right in Leasehold Estates*, appeared in 1731. He died on the 5th of April 1735. Besides the works published in his own name, Derham, who was keenly interested in natural history, contributed a variety of papers to the *Transactions of the Royal Society*, revised the *Miscellanea Curiasa*, edited the correspondence of John Ray and Eleazar Albin's *Natural History*, and published some of the MSS. of Robert Hooke, the natural philosopher.

D'ERLON, JEAN BAPTISTE DROUET, COUNT (1765–1844), marshal of France, was born at Reims on the 29th of July 1765. He entered the army as a private soldier in 1782, was discharged after five years' service, re-entered it in 1792, and rose rapidly to the rank of an officer. From 1794 to 1796 he was aide-de-camp to General Lefebvre. He did good service in the campaigns of the revolutionary wars and in 1799 attained the rank of general of brigade. In the campaign of that year he was engaged in the Swiss operations under Masséna. In 1800 he fought under Moreau at Hohenlinden. As a general of division he took part in Napoleon's campaigns of 1805 and 1806, and rendered excellent service at Jena. He was next engaged under Lefebvre in the siege of Danzig and negotiated the terms of surrender; after this he rejoined the field army and fought at Friedland (1807), receiving a severe wound. After this battle he was made grand officer of the Legion of Honour, was created Count d'Erlon and received a pension. For the next six years d'Erlon was almost continuously engaged as commander of an army corps in the Peninsular War, in which he added greatly to his reputation as a capable general. At the pass of Maya in the Pyrenees he inflicted a defeat upon Lord Hill's troops, and in the subsequent battles of the 1814 campaign he distinguished himself further. After the first Restoration he was named commander of the 16th military division, but he was soon arrested for conspiring with the Orléans party, to which he was secretly devoted. He escaped, however, and gave in his adhesion to Napoleon, who had returned from Elba. The emperor made him a peer of France, and gave him command of the I. army corps, which formed part of the Army of the North. In the Waterloo campaign d'Erlon's corps formed part of Ney's command on the 16th of June, but, in consequence of an extraordinary series of misunderstandings, took part neither at Ligny nor at Quatre Bras (see WATERLOO CAMPAIGN). He was not, however, held to account by Napoleon, and as the latter's practice in such matters was severe to the verge of injustice, it may be presumed that the failure was not due to d'Erlon.

He was in command of the right wing of the French army throughout the great battle of the 18th of June, and fought in the closing operations around Paris. At the second Restoration d'Erlon fled into Germany, only returning to France after the amnesty of 1825. He was not restored to the service until the accession of Louis Philippe, in whose interests he had engaged in several plots and intrigues. As commander of the 12th military division (Nantes), he suppressed the legitimist agitation in his district and caused the arrest of the duchess of Berry (1832). His last active service was in Algeria, of which country he was made governor-general in 1834 at the age of seventy. He returned to France after two years, and was made marshal of France shortly before his death at Paris on the 25th of January 1844.

DERMOT MAC MURROUGH (d. 1171), Irish king of Leinster, succeeded his father in the principality of the Hui Cinsellaigh (1115) and eventually in the kingship of Leinster. The early events of his life are obscure; but about 1152 we find him engaged in a feud with O Ruairc, the lord of Breifne (Leitrim and Cavan). Dermot abducted the wife of O Ruairc more with the object of injuring his rival than from any love of the lady. The injured husband called to his aid Roderic, the high king (aird-righ) of Connaught; and in 1166 Dermot fled before this powerful coalition to invoke the aid of England. Obtaining from Henry II. a licence to enlist allies among the Welsh marchers, Dermot secured the aid of the Clares and Geraldines. To Richard Strongbow, earl of Pembroke and head of the house of Clare, Dermot gave his daughter Eva in marriage; and on his death was succeeded by the earl in Leinster. The historical importance of Dermot lies in the fact that he was the means of introducing the English into Ireland. Through his aid the towns of Waterford, Wexford and Dublin had already become English colonies before the arrival of Henry II. in the island.

See *The Song of Dermot and the Earl, an old French Poem* (by M. Regan ?), ed. with trans. by G. H. Orpen, 1892; Kate Norgate, *England under the Angevin Kings*, vol. ii. (H. W. C. D.)

DERNA (anc. *Darnis-Zarine*), a town on the north coast of Africa and capital of the eastern half of the Ottoman province of Bengazi or Barca. Situated below the eastern butt of Jebel Akhdar on a small but rich deltaic plain, watered by fine perennial springs, it has a growing population and trade, the latter being mainly in fruits grown in its extensive palm gardens, and in hides and wool brought down by the nomads from the interior. If the port were better there would be more rapid expansion. The bay is open from N.W. round to S.E. and often inaccessible in winter and spring, and the steamers of the *Nav. Gen. Italiana* sometimes have to pass without calling. The population has recovered from the great plague epidemic of 1821 and reached its former figure of about 7000. A proportion of it is of Moorish stock, of Andalusian origin, which emigrated in 1493; the descendants preserve a fine facial type. The sheikhs of the local Bedouin tribes have houses in the place, and a Turkish garrison of about 250 men is stationed in barracks. There is a lighthouse W. of the bay. A British consular agent is resident and the Italians maintain a vice-consul. The names Darnis and Zarine are philologically identical and probably refer to the same place. No traces are left of the ancient town except some rock tombs. Darnis continued to be of some importance in early Moslem times as a station on the Alexandria-Kairawan road, and has served on more than one occasion as a base for Egyptian attacks on Cyrenaica and Tripolitana. In 1805 the government of the United States, having a quarrel with the dey of Tripoli on account of piracies committed on American shipping, landed a force to co-operate in the attack on Derna then being made by Sidi Ahmet, an elder brother of the dey. This force, commanded by William Eaton (*q.v.*), built a fort, whose ruins and rusty guns are still to be seen, and began to improve the harbour; but its work quickly came to an end with the conclusion of peace. After 1835 Derna passed under direct Ottoman control, and subsequently served as the point whence the sultan exerted a precarious but increasing control over eastern Cyrenaica and Marmarica. It is now in communication by wireless telegraphy with Rhodes and western Cyrenaica. It is the only town, or even large village, between Bengazi and Alexandria (600 m.). (D. G. H.)

DÉROULÈDE, PAUL (1846–), French author and politician, was born in Paris on the 2nd of September 1846. He made his first appearance as a poet in the pages of the *Revue nationale*, under the pseudonym of Jean Rebel, and in 1869 produced at the Théâtre Français a one-act drama in verse entitled *Juan Strenner*. On the outbreak of the Franco-German War he enlisted as a private, was wounded and taken prisoner at Sedan, and sent to Breslau, but effected his escape. He then served under Chanzy and Bourbaki, took part in the latter's disastrous retreat to Switzerland, and fought against the Commune in Paris. After attaining the rank of lieutenant, he was forced by an accident to retire from the army. He published in 1872 a number of patriotic poems (*Chants du soldat*), which enjoyed unbounded popularity. This was followed in 1875 by another collection, *Nouveaux Chants du soldat*. In 1877 he produced a drama in verse called *L'Hetman*, which derived a passing success from the patriotic fervour of its sentiments. For the exhibition of 1878 he wrote a hymn, *Vive la France*, which was set to music by Gounod. In 1880 his drama in verse, *La Moëbite*, which had been accepted by the Théâtre Français, was forbidden by the censor on religious grounds. In 1882 M. Déroulède founded the *Ligue des patriotes*, with the object of furthering France's "revanche" against Germany. He was one of the first advocates of a Franco-Russian alliance, and as early as 1883 undertook a journey to Russia for

the furtherance of that object. On the rise of General Boulanger, M. Déroulède attempted to use the *Ligue des patriotes*, hitherto a non-political organization, to assist his cause, but was deserted by a great part of the league and forced to resign his presidency. Nevertheless he used the section that remained faithful to him with such effect that the government found it necessary in 1889 to decree its suppression. In the same year he was elected to the chamber as member for Angoulême. He was expelled from the chamber in 1890 for his disorderly interruptions during debate. He did not stand at the elections of 1893, but was re-elected in 1898, and distinguished himself by his violence as a nationalist and anti-Dreyfusard. After the funeral of President Faure, on the 23rd of February 1899, he endeavoured to persuade General Roget to lead his troops upon the Élysée. For this he was arrested, but on being tried for treason was acquitted (May 31). On the 12th of August he was again arrested and accused, together with André Buffet, Jules Guérin and others, of conspiracy against the republic. After a long trial before the high court, he was sentenced, on the 4th of January 1900, to ten years' banishment from France, and retired to San Sebastian. In 1901, he was again brought prominently before the public by a quarrel with his Royalist allies, which resulted in an abortive attempt to arrange a duel with M. Buffet in Switzerland. In November 1905, however, the law of amnesty enabled him to return to France.

Besides the works already mentioned, he published *Le Sergent*, in the *Théâtre de campagne* (1880); *De l'éducation nationale* (1882); *Monsieur le Uhlan et les trois couleurs* (1884); *Le Premier grenadier de France; La Tour d'Auvergne* (1886); *Le Livre de la ligue des patriotes* (1887); *Refrains militaires* (1888); *Histoire d'amour* (1890); a pamphlet entitled *Désarmement?* (1891); *Chants du paysan* (1894); *Poésies militaires* (1896) and *Messire du Guesclin, drame en vers* (1895); *La Mort de Hoche. Cinq actes en prose* (1897); *La Plus belle fille du monde, conte dialogué en vers libres* (1898).

DERRICK, a sort of crane (*q.v.*); the name is derived from that of a famous early 17th-century Tyburn hangman, and was originally applied as a synonym.

DERRING-DO, valour, chivalrous conduct, or "desperate courage," as it is defined by Sir Walter Scott. The word in its present accepted substantival form is a misconstruction of the verbal substantive *dorryng* or *durring*, daring, and *do* or *don*, the present infinitive of "do," the phrase *dorryng do* thus meaning "daring to do." It is used by Chaucer in *Troylus*, and by Lydgate in the *Chronicles of Troy*. Spenser in the *Shepherd's Calendar* first adapted *derring-do* as a substantive meaning "manhood and chevalrie," and this use was revived by Scott, through whom it came into vogue with writers of romance.

DE RUYTER, MICHAEL ADRIANZOON (1607-1676), Dutch naval officer, was born at Flushing on the 24th of March 1607. He began his seafaring life at the age of eleven as a cabin boy, and in 1636 was entrusted by the merchants of Flushing with the command of a cruiser against the French pirates. In 1640 he entered the service of the States, and, being appointed rear-admiral of a fleet fitted out to assist Portugal against Spain, specially distinguished himself at Cape St Vincent, on the 3rd of November 1641. In the following year he left the service of the States, and, until the outbreak of war with England in 1652, held command of a merchant vessel. In 1653 a squadron of seventy vessels was despatched against the English, under the command of Admiral Tromp. Ruyter, who accompanied the admiral in this expedition, seconded him with great skill and bravery in the three battles which were fought with the English. He was afterwards stationed in the Mediterranean, where he captured several Turkish vessels. In 1659 he received a commission to join the king of Denmark in his war with the Swedes. As a reward of his services, the king of Denmark ennobled him and gave him a pension. In 1661 he grounded a vessel belonging to Tunis, released forty Christian slaves, made a treaty with the Tunisians, and reduced the Algerine corsairs to submission. From his achievements on the west coast of Africa he was recalled in 1665 to take command of a large fleet which had been organised against England, and in May of the following year, after a long contest off the North Foreland, he compelled the English to take refuge in the Thames. On the 7th of June 1672 he fought a drawn battle with the combined fleets of England and France, in Southwold or Sole Bay, and after the fight he convoyed safely home a fleet of merchantmen. His valour was displayed to equal advantage in several engagements with the French and English in the following year. In 1676 he was despatched to the assistance of Spain against France in the Mediterranean, and, receiving a mortal wound in the battle on the 21st of April off Messina, died on the 29th at Syracuse. A patent by the king of Spain, investing him with the dignity of duke, did not reach the fleet till after his death. His body was carried to Amsterdam, where a magnificent monument to his memory was erected by command of the states-general.

See *Life* of De Ruyter by Brandt (Amsterdam, 1687), and by Klopp (2nd ed., Hanover, 1858).

DERVISH, a Persian word, meaning "seeking doors," *i.e.* "beggar," and thus equivalent to the Arabic *faqîr* (fakir). Generally in Islam it indicates a member of a religious fraternity, whether mendicant or not; but in Turkey and Persia it indicates more exactly a wandering, begging religious, called, in Arabic-speaking countries, more specifically a *faqir*. With important differences, the dervish fraternities may be compared to the regular religious orders of Roman Christendom, while the Ulema (*q.v.*) are, also with important differences, like the secular clergy. The origin and history of the mystical life in Islam, which led to the growth of the order of dervishes, are treated under Ṣūfi'ism. It remains to treat here more particularly of (1) the dervish fraternities, and (2) the Ṣūfī hierarchy.

1. *The Dervish Fraternities.*—In the earlier times, the relation between devotees was that of master and pupil. Those inclined to the spiritual life gathered round a revered sheikh (*murshid*, "guide," *ustadh*, *pir*, "teacher"), lived with him, shared his religious practices and were instructed by him. In time of war against the unbelievers, they might accompany him to the threatened frontier, and fight under his eye. Thus *murābit*, "one who pickets his horse on a hostile frontier," has become the *marabout* (*q.v.*) or dervish of French Algeria; and *ribat*, "a frontier fort," has come to mean a monastery. The relation, also, might be for a time only. The pupil might at any time return to the world, when his religious education and training were complete. On the death of the master the memory of his life and sayings might go down from generation to generation, and men might boast themselves as pupils of his pupils. Continuous corporations to perpetuate his name were slow in forming. Ghazali himself, though he founded, taught and ruled a Ṣūfi cloister (*khānqāh*) at Tus, left no order behind him. But 'Adī al-Hakkārī, who founded a cloister at Mosul and died about 1163, was long reverenced by the 'Adawite Fraternity, and in 1166 died 'Abd al-Qādir al-Jīlānī, from whom the Qādirite order descends, one of the greatest and most influential to this day. The troublous times of the break up of the Seljuk rule may have been a cause in this, as, with St Benedict, the crumbling Roman empire. Many existing fraternities, it is true, trace their origin to saints of the third, second and even first Moslem centuries, but that is legend purely. Similar is the tendency to claim all the early pious Moslems as good Ṣūfīs; collections of Ṣūfī biography begin with the ten to whom Mahomet promised Paradise. So, too, the ultimate origin of fraternities is assigned to either Ali or Abu Bekr, and in Egypt all are under the rule of a direct descendant of the latter.

To give a complete list of these fraternities is quite impossible. Commonly, thirty-two are reckoned, but many have vanished or have been suppressed, and there are sub-orders innumerable. Each has a "rule" dating back to its founder, and a ritual which the members perform when they meet together in their convent (*khānqāh*, *zāwiya*, *takya*). This may consist simply in the repetition of sacred phrases, or it may be an elaborate performance, such as the whirlings of the dancing dervishes, the Mevlevites, an order founded by Jelāl ud-Dīn ar-Rūmī, the author of the

great Persian mystical poem, the *Mesnevi*, and always ruled by one of his descendants. Jelāl ud-Dīn was an advanced pantheist, and so are the Mevlevites, but that seems only to earn them the dislike of the Ulema, and not to affect their standing in Islam. They are the most broad-minded and tolerant of all. There are also the performances of the Rifā'ites or "howling dervishes." In ecstasy they cut themselves with knives, eat live coals and glass, handle red-hot iron and devour serpents. They profess miraculous healing powers, and the head of the Sa'dites, a sub-order, used, in Cairo, to ride over the bodies of his dervishes without hurting them, the so-called Dōseh (*dausa*). These different abilities are strictly regulated. Thus, one sub-order may eat glass and another may eat only serpents. Another division is made by their attitude to the law of Islam. When a dervish is in a state of ecstasy (*majdhūb*), he is supposed to be unconscious of the actions of his body. Reputed saints, therefore, can do practically anything, as their souls will be supposed to be out of their bodies and in the heavenly regions. They may not only commit the vilest of actions, but neglect in general the ceremonial and ritual law. This goes so far that in Persia and Turkey dervish orders are classified as *bā-shar'*, "with law," and *bī-shar'*, "without law." The latter are really antinomians, and the best example of them is the Bakhtashite order, widely spread and influential in Turkey and Albania and connected by legend with the origin of the Janissaries. The Qalandarite order is known to all from the "Calenders" of the *Thousand and One Nights*. They separated from the Bakhtashites and are under obligation of perpetual travelling. The Senussi (Senussia) were the last order to appear, and are distinguished from the others by a severely puritanic and reforming attitude and strict orthodoxy, without any admixture of mystical slackness in faith or conduct. Each order is distinguished by a peculiar garb. Candidates for admission have to pass through a noviciate, more or less lengthy. First comes the *'ahd*, or initial covenant, in which the neophyte or *murīd*, "seeker," repents of his past sins and takes the sheikh of the order he enters as his guide (*murshid*) for the future. He then enters upon a course of instruction and discipline, called a "path" (*tarīqa*), on which he advances through diverse "stations" (*maqāmāt*) or "passes" (*'aqabat*) of the spiritual life. There is a striking resemblance here to the gnostic system, with its seven Archon-guarded gates. On another side, it is plain that the sheikh, along with ordinary instruction of the novice, also hypnotizes him and causes him to see a series of visions, marking his penetration of the divine mystery. The part that hypnosis and autohypnosis, conscious and unconscious, has played here cannot easily be overestimated. The Mevlevites seem to have the most severe noviciate. Their aspirant has to labour as a lay servitor of the lowest rank for 1001 days—called the *kārrā kolak*, or "jackal"—before he can be received. For one day's failure he must begin again from the beginning.

But besides these full members there is an enormous number of lay adherents, like the tertiaries of the Franciscans. Thus, nearly every religious man of the Turkish Moslem world is a lay member of one order or another, under the duty of saying certain prayers daily. Certain trades, too, affect certain orders. Most of the Egyptian Qādirites, for example, are fishermen and, on festival days, carry as banners nets of various colours. On this side, the orders bear a striking resemblance to lodges of Freemasons and other friendly societies, and points of direct contact have even been alleged between the more pantheistic and antinomian orders, such as the Bakhtashite, and European Freemasonry. On another side, just as the *dhikrs* of the early ascetic mystics suggest comparison with the class-meetings of the early Methodists, so these orders are the nearest approach in Islam to the different churches of Protestant Christendom. They are the only ecclesiastical organization that Islam has ever known, but it is a multiform organization, unclassified internally or externally. They differ thus from the Roman monastic orders, in that they are independent and self-developing, each going its own way in faith and practice, limited only by the universal conscience (*ijmā'*, "agreement": see MAHOMMEDAN LAW) of Islam. Strange doctrines and moral defects may develop, but freedom is saved, and the whole people of Islam can be reached and affected.

2. *Saints and the Ṣūfī Hierarchy.*—That an elaborate doctrine of wonder-working saints should have grown up in Islam may, at first sight, appear an extreme paradox. It can, however, be conditioned and explained. First, Mahomet left undoubted loop-holes for a minor inspiration, legitimate and illegitimate. Secondly, the Ṣūfīs, under various foreign influences, developed these to the fullest. Thirdly, just as the Christian church has absorbed much of the mythology of the supposed exterminated heathen religions into its cult of local saints, so Islam, to an even higher degree, has been overlaid and almost buried by the superstitions of the peoples to which it has gone. Their religious and legal customs have completely overcome the direct commands of the Koran, the traditions from Mahomet and even the "Agreement" of the rest of the Moslem world (see MAHOMMEDAN LAW). The first step in this, it is true, was taken by Mahomet himself when he accepted the Meccan pilgrimage and the Black Stone. The worship of saints, therefore, has appeared everywhere in Islam, with an absolute belief in their miracles and in the value of their intercession, living or dead.

Further, there appeared very early in Islam a belief that there was always in existence some individual in direct intercourse with God and having the right and duty of teaching and ruling all mankind. This individual might be visible or invisible; his right to rule continued. This is the basis of the Ismā'īlite and Shī'ite positions (see MAHOMMEDAN RELIGION and MAHOMMEDAN INSTITUTIONS). The Ṣūfīs applied this idea of divine right to the doctrine of saints, and developed it into the Sūfi hierarchy. This is a single, great, invisible organization, forming a saintly board of administration, by which the invisible government of the world is supposed to be carried on. Its head is called the *Qutb* (Axis); he is presumably the greatest saint of the time, is chosen by God for the office and given greater miraculous powers and rights of intercession than any other saint enjoys. He wanders through the world, often invisible and always unknown, performing the duties of his office. Under him there is an elaborate organization of *walīs* of different ranks and powers, according to their sanctity and faith. The term *walī* is applied to a saint because of Kor. x. 63, "Ho! the *walīs* of God; there is no fear upon them, nor do they grieve," where *walī* means "one who is near," a friend or favourite.

In the fraternities, then, all are dervishes, cloistered or lay; those whose faith is so great that God has given them miraculous powers—and there are many—are *walīs*; begging friars are *fakirs*. All forms of life—solitary, monastic, secular, celibate, married, wandering, stationary, ascetic, free—are open. Their theology is some form of Sūfi'ism.

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DERWENT (Celtic *Dwr-gent*, clear water), the name of several English rivers. (1) The Yorkshire Derwent collects the greater part of the drainage of the North Yorkshire moors, rising in their eastern part. A southern head-stream, however, rises in the Yorkshire Wolds near Filey, little more than a mile from the North Sea, from which it is separated by a morainic deposit, and thus flows in an inland direction. The early course of the Derwent lies through a flat open valley between the North Yorkshire moors and the Yorkshire Wolds, the upper part of which is known as the Carrs, when the river follows an artificial drainage cut. It receives numerous tributaries from the moors, then breaches the

low hills below Malton in a narrow picturesque valley, and debouches upon the central plain of Yorkshire. Its direction, hitherto westerly and south-westerly from the Carrs, now becomes southerly, and it flows roughly parallel to the Ouse, which it joins near Barmby-on-the-Marsh, in the level district between Selby and the head of the Humber estuary, after a course, excluding minor sinuosities, of about 70 m. As a tributary of the Ouse it is included in the Humber basin. It is tidal up to Sutton-upon-Derwent, 15 m. from the junction with the Ouse, and is locked up to Malton, but the navigation is little used. A canal leads east from the tidal water to the small market town of Pocklington.

(2) The Derbyshire Derwent rises in Bleaklow Hill north of the Peak and traverses a narrow dale, which, with those of such tributary streams as the Noe, watering Hope Valley, and the Wye, is famous for its beauty (see DERBYSHIRE). The Derwent flows south past Chatsworth, Matlock and Belper and then, passing Derby, debouches upon a low plain, and turns south-eastward, with an extremely sinuous course, to join the Trent near Sawley. Its length is about 60 m. It falls in all some 1700 ft. (from Matlock 200 ft.), and no part is navigable, save certain reaches at Matlock and elsewhere for pleasure boats.

(3) The Cumberland Derwent rises below Great End in the Lake District, draining Spinkling and Sty Head tarns, and flows through Borrowdale, receiving a considerable tributary from Lang Strath. It then drains the lakes of Derwentwater and Bassenthwaite, after which its course, hitherto N. and N.N.W., turns W. and W. by S. past Cockermouth to the Irish Sea at Workington. The length is about 34 m., and the fall about 2000 ft. (from Derwentwater 244 ft.); the waters are usually beautifully clear, and the river is not navigable. At a former period this stream must have formed one large lake covering the whole area which includes Derwentwater and Bassenthwaite; between which a flat alluvial plain is formed of the deposits of the river Greta, which now joins the Derwent from the east immediately below Derwentwater, and the Newlands Beck, which enters Bassenthwaite. In time of high flood this plain is said to have been submerged, and the two lakes thus reunited.

(4) A river Derwent rises in the Pennines near the borders of Northumberland and Durham, and, forming a large part of the boundary between these counties, takes a north-easterly course of 30 m. to the Tyne, which it joins 3 m. above Newcastle.

DERWENTWATER, EARL OF, an English title borne by the family of Radclyffe, or Radcliffe, from 1688 to 1716 when the 3rd earl was attainted and beheaded, and claimed by his descendants, adherents of the exiled house of Stewart, from that date until the death of the last male heir in 1814. Sir Francis Radclyffe, 3rd baronet (1625–1697), was the lineal descendant of Sir Nicholas Radclyffe, who acquired the extensive Derwentwater estates in 1417 through his marriage with the heiress of John de Derwentwater, and of Sir Francis Radclyffe, who was made a baronet in 1619. In 1688 Sir Francis was created Viscount Radclyffe and earl of Derwentwater by James II., and dying in 1697 was succeeded as 2nd earl by his eldest son Edward (1655–1705), who had married Lady Mary Tudor (d. 1726), a natural daughter of Charles II. The 2nd earl died in 1705, and was succeeded by his eldest son James (1689–1716), who was born in London on the 28th of June 1689, and was brought up at the court of the Stewarts in France as companion to Prince James Edward, the old Pretender. In 1710 he came to reside on his English estates, and in July 1712 was married to Anna Maria (d. 1723), daughter of Sir John Webb, baronet, of Odstock, Wiltshire. Joining without any hesitation in the Stewart rising of 1715, Derwentwater escaped arrest owing to the devotion of his tenantry, and in October, with about seventy followers, he joined Thomas Forster at Green-rig. Like Forster the earl was lacking in military experience, and when the rebels capitulated at Preston he was conveyed to London and impeached. Pleading guilty at his trial he was attainted and condemned to death. Great efforts were made to obtain a mitigation of the sentence, but the government was obdurate, and Derwentwater was beheaded on Tower Hill on the 24th of February 1716, declaring on the scaffold his devotion to the Roman Catholic religion and to King James III. The earl was very popular among his tenantry and in the neighbourhood of his residence, Dilston Hall. His gallant bearing and his sad fate have been celebrated in song and story, and the *aurora borealis*, which shone with exceptional brightness on the night of his execution, is known locally as "Lord Derwentwater's lights." He left an only son John, who, in spite of his father's attainder, assumed the title of earl of Derwentwater, and who died unmarried in 1731; and a daughter Alice Mary (d. 1760), who married in 1732 Robert James, 8th Baron Petre (1713–1742).

On the death of John Radclyffe in 1731 his uncle Charles (1693–1746), the only surviving son of the 2nd earl, took the title of earl of Derwentwater. Charles Radclyffe had shared the fate of his brother, the 3rd earl, at Preston in November 1715, and had been condemned to death for high treason; but, more fortunate than James, he had succeeded in escaping from prison, and had joined the Stewarts on the Continent. In 1724 he married Charlotte Maria (d. 1755), in her own right countess of Newburgh, and after spending some time in Rome, he was captured by an English ship in November 1745 whilst proceeding to join Charles Edward, the young Pretender, in Scotland. Condemned to death under his former sentence he was beheaded on the 8th of December 1746. His eldest son, James Bartholomew (1725–1786), who had shared his father's imprisonment, then claimed the title of earl of Derwentwater, and on his mother's death in 1755 became 3rd earl of Newburgh. His only son and successor, Anthony James (1757–1814), died without issue in 1814, when the title became extinct *de facto* as well as *de jure*. Many of the forfeited estates in Northumberland and Cumberland had been settled upon Greenwich Hospital, and in 1749 a sum of £30,000 had been raised upon them for the benefit of the earl of Newburgh. The present representative of the Radclyffe family is Lord Petre, and in 1874 the bodies of the first three earls of Derwentwater were reburied in the family vault of the Petres at Thorndon, Essex.

In 1865 a woman appeared in Northumberland who claimed to be a grand-daughter of the 4th earl and, as there were no male heirs, to be countess of Derwentwater and owner of the estates. She said the 4th earl had not died in 1731 but had married and settled in Germany. Her story aroused some interest, and it was necessary to eject her by force from Dilston Hall.

See R. Patten, *History of the Late Rebellion* (London, 1717); W. S. Gibson, *Dilston Hall, or Memoirs of James Radcliffe, earl of Derwentwater* (London, 1848–1850); G. E. C(okayne), *Complete Peerage* (Exeter, 1887–1898); and *Dictionary of National Biography*, vol. xlvii. (London, 1896).

DERWENTWATER, a lake of Cumberland, England, in the northern part of the celebrated Lake District (*q.v.* for the physical relations of the lake with the district at large). It is of irregular figure, approaching to an oval, about 3 m. in length and from ½ m. to 1¼ m. in breadth. The greatest depth is 70 ft. The lake is seen at one view, within an amphitheatre of mountains of varied outline, overlooked by others of greater height. Several of the lesser elevations near the lake are especially famous as view-points, such as Castle Head, Walla Crag, Ladder Brow and Cat Bells. The shores are well wooded, and the lake is studded with several islands, of which Lord's Island, Derwent Isle and St Herbert's are the principal. Lord's Island was the residence of the earls of Derwentwater. St Herbert's Isle receives its name from having been the abode of a holy man of that name mentioned by Bede as contemporary with St Cuthbert of Farne Island in the 7th century. Derwent Isle, about six acres in extent, contains a handsome residence surrounded by lawns, gardens and timber of large growth. The famous Falls of Lodore, at the upper end of the lake, consist of a series of cascades in the small Watendlath Beck, which rushes over an enormous pile of protruding crags from a height of nearly 200 ft. The "Floating Island" appears at intervals on the upper portion of the lake near the mouth of the beck. This singular phenomenon is supposed to owe its appearance to an accumulation of gas, formed by the decay of

vegetable matter, detaching and raising to the surface the matted weeds which cover the floor of the lake at this point. The river Derwent (*q.v.*) enters the lake from the south and leaves it on the north, draining it through Bassenthwaite lake, to the Irish Sea. To the north-east of the lake lies the town of Keswick.

DES ADRETS, FRANÇOIS DE BEAUMONT, Baron (*c.* 1512–1587), French Protestant leader, was born in 1512 or 1513 at the château of La Frette (Isère). During the reign of Henry II. of France he served with distinction in the royal army and became colonel of the "legions" of Dauphiné, Provence and Languedoc. In 1562, however, he joined the Huguenots, not from religious conviction but probably from motives of ambition and personal dislike of the house of Guise. His campaign against the Catholics in 1562 was eminently successful. In June of that year Des Adrets was master of the greater part of Dauphiné. But his brilliant military qualities were marred by his revolting atrocities. The reprisals he exacted from the Catholics after their massacres of the Huguenots at Orange have left a dark stain upon his name. The garrisons that resisted him were butchered with every circumstance of brutality, and at Montbrison, in Forez, he forced eighteen prisoners to precipitate themselves from the top of the keep. Having alienated the affections of the Huguenots by his pride and violence, he entered into communication with the Catholics, and declared himself openly in favour of conciliation. On the 10th of January 1563 he was arrested on suspicion by some Huguenot officers and confined in the citadel of Nîmes. He was liberated at the edict of Amboise in the following March, and, distrusted alike by Huguenots and Catholics, retired to the château of La Frette, where he died, a Catholic, on the 2nd of February 1587.

Authorities.—J. Roman, *Documents inédits sur le baron des Adrets* (1878); and memoirs and histories of the time. See also Guy Allard, *Vie de François de Beaumont* (1675); l'abbé J. C. Martin, *Histoire politique et militaire de François de Beaumont* (1803); Eugène and Émile Haag, *La France protestante* (2nd ed., 1877 seq.).

DESAIX DE VEYGOUX, LOUIS CHARLES ANTOINE (1768–1800), French general, was born of a noble though impoverished family. He received a military education at the school founded by Marshal d'Effiat, and entered the French royal army. During the first six years of his service the young officer devoted himself assiduously to duty and the study of his profession, and at the outbreak of the Revolution threw himself whole-heartedly into the cause of liberty. In spite of the pressure put upon him by his relatives, he refused to "emigrate," and in 1792 is found serving on Broglie's staff. The disgrace of this general nearly cost young Desaix his life, but he escaped the guillotine, and by his conspicuous services soon drew upon himself the favour of the Republican government. Like many other members of the old ruling classes who had accepted the new order of things, the instinct of command, joined to native ability, brought Desaix rapidly to high posts. By 1794 he had attained the rank of general of division. In the campaign of 1795 he commanded Jourdan's right wing, and in Moreau's invasion of Bavaria in the following year he held an equally important command. In the retreat which ensued when the archduke Charles won the battles of Amberg and Würzburg (see French Revolutionary Wars) Desaix commanded Moreau's rearguard, and later the fortress of Kehl, with the highest distinction, and his name became a household word, like those of Bonaparte, Jourdan, Hoche, Marceau and Kléber. Next year his initial successes were interrupted by the Preliminaries of Leoben, and he procured for himself a mission into Italy in order to meet General Bonaparte, who spared no pains to captivate the brilliant young general from the almost rival camps of Germany. Provisionally appointed commander of the "Army of England," Desaix was soon transferred by Bonaparte to the expeditionary force intended for Egypt. It was his division which bore the brunt of the Mameluke attack at the battle of the Pyramids, and he crowned his reputation by his victories over Murad Bey in Upper Egypt. Amongst the fellaheen he acquired the significant appellation of the "Just Sultan." When his chief handed over the command to Kléber and prepared to return to France, Desaix was one of the small party selected to accompany the future emperor. But, from various causes, it was many months before he could join the new Consul. The campaign of 1800 was well on its way to the climax when Desaix at last reported himself for duty in Italy. He was immediately assigned to the command of a corps of two infantry divisions. Three days later (June 14), detached, with Boudet's division, at Rivalta, he heard the cannon of Marengo on his right. Taking the initiative he marched at once towards the sound, meeting Bonaparte's staff officer, who had come to recall him, half way on the route. He arrived with Boudet's division at the moment when the Austrians were victorious all along the line. Exclaiming, "There is yet time to win another battle!" he led his three regiments straight against the enemy's centre. At the moment of victory Desaix was killed by a musket ball. Napoleon paid a just tribute to the memory of one of the most brilliant soldiers of that brilliant time by erecting the monuments of Desaix on the Place Dauphiné and the Place des Victoires in Paris.

See F. Martha-Beker, Comte de Mons, *Le Général L. C. A. Desaix* (Paris, 1852).

DÉSAUGIERS, MARC ANTOINE MADELEINE (1772–1827), French dramatist and song-writer, son of Marc Antoine Désaugiers, a musical composer, was born at Fréjus (Var) on the 17th of November 1772. He studied at the Mazarin college in Paris, where he had for one of his teachers the critic Julien Louis Geoffroy. He entered the seminary Saint Lazare with a view to the priesthood, but soon gave up his intention. In his nineteenth year he produced in collaboration with his father a light opera (1791) adapted from the *Médecin malgré lui* of Molière.

During the Revolution he emigrated to St Domingo, and during the negro revolt he was made prisoner, barely escaping with his life. He took refuge in the United States, where he supported himself by teaching the piano. In 1797 he returned to his native country, and in a very few years he became famous as a writer of comedies, operas and vaudevilles, which were produced in rapid succession at the Théâtre des Variétés and the Vaudeville. He also wrote convivial and satirical songs, which, though different in character, can only worthily be compared with those of Béranger. He was at one time president of the *Caveau*, a convivial society whose members were then chiefly drawn from literary circles. He had the honour of introducing Béranger as a member. In 1815 Désaugiers succeeded Pierre Yves Barré as manager of the Vaudeville, which prospered under his management until, in 1820, the opposition of the Gymnase proved too strong for him, and he resigned. He died in Paris on the 9th of August 1827.

Among his pieces may be mentioned *Le Valet d'emprunt* (1807); *Monsieur Vautour* (1811); and *Le Règne d'un terme et le terme d'un règne*, aimed at Napoleon.

An edition of Désaugiers' *Chansons et Poésies diverses* appeared in 1827. A new selection with a notice by Alfred de Bougy appeared in 1858. See also Sainte-Beuve's *Portraits contemporains*, vol. v.

DESAULT, PIERRE JOSEPH (1744–1795), French anatomist and surgeon, was born at Magny-Vernois (Haute Saône) on the 6th of February 1744. He was destined for the church, but his own inclination was towards the study of medicine; and, after learning something from the barber-surgeon of his native village, he was settled as an apprentice in the military hospital of Belfort, where he acquired some knowledge of anatomy and military surgery. Going to Paris when about twenty years of age, he opened a school of anatomy in the winter of 1766, the success of which excited the jealousy of the established teachers and professors, who endeavoured to make him give up his lectures. In 1776 he was admitted a member of the corporation of surgeons; and in 1782 he was appointed surgeon-major to the hospital *De la Charité*. Within a few years he was recognized as one of the leading surgeons of France. The clinical school of surgery which he instituted at the Hôtel Dieu attracted great numbers of students, not only from every part of France but also from other countries; and he frequently had an audience of about 600. He introduced many improvements into the practice of surgery, as well as into the construction of various surgical

low hills below Malton in a narrow picturesque valley, and debouches upon the central plain of Yorkshire. Its direction, hitherto westerly and south-westerly from the Carrs, now becomes southerly, and it flows roughly parallel to the Ouse, which it joins near Barmby-on-the-Marsh, in the level district between Selby and the head of the Humber estuary, after a course, excluding minor sinuosities, of about 70 m. As a tributary of the Ouse it is included in the Humber basin. It is tidal up to Sutton-upon-Derwent, 15 m. from the junction with the Ouse, and is locked up to Malton, but the navigation is little used. A canal leads east from the tidal water to the small market town of Pocklington.

(2) The Derbyshire Derwent rises in Bleaklow Hill north of the Peak and traverses a narrow dale, which, with those of such tributary streams as the Noe, watering Hope Valley, and the Wye, is famous for its beauty (see DERBYSHIRE). The Derwent flows south past Chatsworth, Matlock and Belper and then, passing Derby, debouches upon a low plain, and turns south-eastward, with an extremely sinuous course, to join the Trent near Sawley. Its length is about 60 m. It falls in all some 1700 ft. (from Matlock 200 ft.), and no part is navigable, save certain reaches at Matlock and elsewhere for pleasure boats.

(3) The Cumberland Derwent rises below Great End in the Lake District, draining Spinkling and Sty Head tarns, and flows through Borrowdale, receiving a considerable tributary from Lang Strath. It then drains the lakes of Derwentwater and Bassenthwaite, after which its course, hitherto N. and N.N.W., turns W. and W. by S. past Cockermouth to the Irish Sea at Workington. The length is about 34 m., and the fall about 2000 ft. (from Derwentwater 244 ft.); the waters are usually beautifully clear, and the river is not navigable. At a former period this stream must have formed one large lake covering the whole area which includes Derwentwater and Bassenthwaite; between which a flat alluvial plain is formed of the deposits of the river Greta, which now joins the Derwent from the east immediately below Derwentwater, and the Newlands Beck, which enters Bassenthwaite. In time of high flood this plain is said to have been submerged, and the two lakes thus reunited.

(4) A river Derwent rises in the Pennines near the borders of Northumberland and Durham, and, forming a large part of the boundary between these counties, takes a north-easterly course of 30 m. to the Tyne, which it joins 3 m. above Newcastle.

DERWENTWATER, EARL OF, an English title borne by the family of Radclyffe, or Radcliffe, from 1688 to 1716 when the 3rd earl was attainted and beheaded, and claimed by his descendants, adherents of the exiled house of Stewart, from that date until the death of the last male heir in 1814. Sir Francis Radclyffe, 3rd baronet (1625–1697), was the lineal descendant of Sir Nicholas Radclyffe, who acquired the extensive Derwentwater estates in 1417 through his marriage with the heiress of John de Derwentwater, and of Sir Francis Radclyffe, who was made a baronet in 1619. In 1688 Sir Francis was created Viscount Radclyffe and earl of Derwentwater by James II., and dying in 1697 was succeeded as 2nd earl by his eldest son Edward (1655–1705), who had married Lady Mary Tudor (d. 1726), a natural daughter of Charles II. The 2nd earl died in 1705, and was succeeded by his eldest son James (1689–1716), who was born in London on the 28th of June 1689, and was brought up at the court of the Stewarts in France as companion to Prince James Edward, the old Pretender. In 1710 he came to reside on his English estates, and in July 1712 was married to Anna Maria (d. 1723), daughter of Sir John Webb, baronet, of Odstock, Wiltshire. Joining without any hesitation in the Stewart rising of 1715, Derwentwater escaped arrest owing to the devotion of his tenantry, and in October, with about seventy followers, he joined Thomas Forster at Green-rig. Like Forster the earl was lacking in military experience, and when the rebels capitulated at Preston he was conveyed to London and impeached. Pleading guilty at his trial he was attainted and condemned to death. Great efforts were made to obtain a mitigation of the sentence, but the government was obdurate, and Derwentwater was beheaded on Tower Hill on the 24th of February 1716, declaring on the scaffold his devotion to the Roman Catholic religion and to King James III. The earl was very popular among his tenantry and in the neighbourhood of his residence, Dilston Hall. His gallant bearing and his sad fate have been celebrated in song and story, and the *aurora borealis*, which shone with exceptional brightness on the night of his execution, is known locally as "Lord Derwentwater's lights." He left an only son John, who, in spite of his father's attainder, assumed the title of earl of Derwentwater, and who died unmarried in 1731; and a daughter Alice Mary (d. 1760), who married in 1732 Robert James, 8th Baron Petre (1713–1742).

On the death of John Radclyffe in 1731 his uncle Charles (1693–1746), the only surviving son of the 2nd earl, took the title of earl of Derwentwater. Charles Radclyffe had shared the fate of his brother, the 3rd earl, at Preston in November 1715, and had been condemned to death for high treason; but, more fortunate than James, he had succeeded in escaping from prison, and had joined the Stewarts on the Continent. In 1724 he married Charlotte Maria (d. 1755), in her own right countess of Newburgh, and after spending some time in Rome, he was captured by an English ship in November 1745 whilst proceeding to join Charles Edward, the young Pretender, in Scotland. Condemned to death under his former sentence he was beheaded on the 8th of December 1746. His eldest son, James Bartholomew (1725–1786), who had shared his father's imprisonment, then claimed the title of earl of Derwentwater, and on his mother's death in 1755 became 3rd earl of Newburgh. His only son and successor, Anthony James (1757–1814), died without issue in 1814, when the title became extinct *de facto* as well as *de jure*. Many of the forfeited estates in Northumberland and Cumberland had been settled upon Greenwich Hospital, and in 1749 a sum of £30,000 had been raised upon them for the benefit of the earl of Newburgh. The present representative of the Radclyffe family is Lord Petre, and in 1874 the bodies of the first three earls of Derwentwater were reburied in the family vault of the Petres at Thorndon, Essex.

In 1865 a woman appeared in Northumberland who claimed to be a grand-daughter of the 4th earl and, as there were no male heirs, to be countess of Derwentwater and owner of the estates. She said the 4th earl had not died in 1731 but had married and settled in Germany. Her story aroused some interest, and it was necessary to eject her by force from Dilston Hall.

See R. Patten, *History of the Late Rebellion* (London, 1717); W. S. Gibson, *Dilston Hall, or Memoirs of James Radcliffe, earl of Derwentwater* (London, 1848–1850); G. E. C(okayne), *Complete Peerage* (Exeter, 1887–1898); and *Dictionary of National Biography*, vol. xlvii. (London, 1896).

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Netherlands was distracted by the quarrels of Gomarists and Arminians. During the leisure thus arising, Descartes one day had his attention drawn to a placard in the Dutch tongue; as the language, of which he never became perfectly master, was then strange to him, he asked a bystander to interpret it into either French or Latin. The stranger, Isaac Beeckman, principal of the college of Dort, offered to do so into Latin, if the inquirer would bring him a solution of the problem,—for the advertisement was one of those challenges which the mathematicians of the age were accustomed to throw down to all comers, daring them to discover a geometrical mystery known as they fancied to themselves alone. Descartes promised and fulfilled; and a friendship grew up between him and Beeckman—broken only by the dishonesty of the latter, who in later years took credit for the novelty contained in a small essay on music (*Compendium Musicae*) which Descartes wrote at this period and entrusted to Beeckman.[1]

After spending two years in Holland as a soldier in a period of peace, Descartes, in July 1619, attracted by the news of the impending struggle between the house of Austria and the Protestant princes, consequent upon the election of the palatine of the Rhine to the kingdom of Bohemia, set out for upper Germany, and volunteered into the Bavarian service. The winter of 1619, spent in quarters at Neuburg on the Danube, was the critical period in his life. Here, in his warm room (*dans un poêle*), he indulged those meditations which afterwards led to the *Discourse of Method*. It was here that, on the eve of St Martin's day, he "was filled with enthusiasm, and discovered the foundations of a marvellous science." He retired to rest with anxious thoughts of his future career, which haunted him through the night in three dreams that left a deep impression on his mind. The date of his philosophical conversion is thus fixed to a day. But as yet he had only glimpses of a logical method which should invigorate the syllogism by the co-operation of ancient geometry and modern algebra. For during the year that elapsed before he left Swabia (and whilst he sojourned at Neuburg and Ulm), and amidst his geometrical studies, he would fain have gathered some knowledge of the mystical wisdom attributed to the Rosicrucians; but the Invisibles, as they called themselves, kept their secret. He was present at the battle of Weisser Berg (near Prague), where the hopes of the elector palatine were blasted (November 8, 1620), passed the winter with the army in southern Bohemia, and next year served in Hungary under Karl Bonaventura de Longueval, Graf von Buquoy or Boucquoi (1571–1621). On the death of this general Descartes quitted the imperial service, and in July 1621 began a peaceful tour through Moravia, the borders of Poland, Pomerania, Brandenburg, Holstein and Friesland, from which he reappeared in February 1622 in Belgium, and betook himself directly to his father's home at Rennes in Brittany.

At Rennes Descartes found little to interest him; and, after he had visited the maternal estate of which his father now put him in possession, he went to Paris, where he found the Rosicrucians the topic of the hour, and heard himself credited with partnership in their secrets. A short visit to Brittany enabled him, with his father's consent, to arrange for the sale of his property in Poitou. The proceeds were invested in such a way at Paris as to bring him in a yearly income of between 6000 and 7000 francs (equal now to more than £500). Towards the end of the year Descartes was on his way to Italy. The natural phenomena of Switzerland, and the political complications in the Valtellina, where the Catholic inhabitants had thrown off the yoke of the Grisons and called in the Papal and Spanish troops to their assistance, delayed him some time; but he reached Venice in time to see the ceremony of the doge's wedlock with the Adriatic. After paying his vows at Loretto, he came to Rome, which was then on the eve of a year of jubilee—an occasion which Descartes seized to observe the variety of men and manners which the city then embraced within its walls. In the spring of 1625 he returned home by Mont Cenis, observing the avalanches,[2] instead of, as his relatives hoped, securing a post in the French army in Piedmont.

For an instant Descartes seems to have concurred in the plan of purchasing a post at Châtellerault, but he gave up the idea, and settled in Paris (June 1625), in the quarter where he had sought seclusion before. By this time he had ceased to devote himself to pure mathematics, and in company with his friends Mersenne and Mydorge was deeply interested in the theory of the refraction of light, and in the practical work of grinding glasses of the best shape suitable for optical instruments. But all the while he was engaged with reflections on the nature of man, of the soul and of God, and for a while he remained invisible even to his most familiar friends. But their importunity made a hermitage in Paris impossible; a graceless friend even surprised the philosopher in bed at eleven in the morning meditating and taking notes. In disgust, Descartes started for the west to take part in the siege of La Rochelle, and entered the city with the troops (October 1628). A meeting at which he was present after his return to Paris decided his vocation. He had expressed an opinion that the true art of memory was not to be gained by technical devices, but by a philosophical apprehension of things; and the cardinal de Berulle, the founder of the Congregation of the Oratory, was so struck by the tone of the remarks as to impress upon the speaker the duty of spending his life in the examination of truth. Descartes accepted the philosophic mission, and in the spring of 1629 he settled in Holland. His financial affairs he had entrusted to the care of the abbé Picot, and as his literary and scientific representative he adopted Mersenne.

Till 1649 Descartes lived in Holland. Thrice only did he revisit France—in 1644, 1647 and 1648. The first of these occasions was in order to settle family affairs after the death of his father in 1640. The second brief visit, in 1647, partly on literary, partly on family business, was signalized by the award of a pension of 3000 francs, obtained from the royal bounty by Cardinal Mazarin. The last visit in 1648 was less fortunate. A royal order summoned him to France for new honours—an additional pension and a permanent post—for his fame had by this time gone abroad, and it was the age when princes sought to attract genius and learning to their courts. But when Descartes arrived, he found Paris rent asunder by the civil war of the Fronde. He paid the costs of his royal parchment, and left without a word of reproach. The only other occasions on which he was out of the Netherlands were in 1630, when he made a flying visit to England to observe for himself some alleged magnetic phenomena, and in 1634, when he took an excursion to Denmark.

During his residence in Holland he lived at thirteen different places, and changed his abode twenty-four times. In the choice of these spots two motives seem to have influenced him—the neighbourhood of a university or college, and the amenities of the situation. Among these towns were Franeker in Friesland, Harderwyk, Deventer, Utrecht, Leiden, Amersfoort, Amsterdam, Leeuwarden in Friesland. His favourite residences were Endegeest, Egmond op den Hoef and Egmond the Abbey (west of Zaandam).

The time thus spent seems to have been on the whole happy, even allowing for warm discussions with the mathematicians and metaphysicians of France, and for harassing controversies in the Netherlands. Friendly agents—chiefly Catholic priests—were the intermediaries who forwarded his correspondence from Dort, Haarlem, Amsterdam and Leiden to his proper address, which he kept completely secret; and Father Mersenne sent him objections and questions. His health, which in his youth had been bad, improved. "I sleep here ten hours every night," he writes from Amsterdam, "and no care ever shortens my slumber." "I take my walk every day through the confusion of a great multitude with as much freedom and quiet as you could find in your rural avenues."[3] At his first coming to Franeker he arranged to get a cook acquainted with French cookery; but,

[1] It was only published after the author's death; and of it, besides the French version, there exists an English translation "by a Person of Quality."

[2] *Œuvres*, v. 255.

[3] *Ib.* vi. 199.

to prevent misunderstanding, it may be added that his diet was mainly vegetarian, and that he rarely drank wine. New friends gathered round him who took a keen interest in his researches. Once only do we find him taking an interest in the affairs of his neighbours,—to ask pardon from the government for a homicide.[1] He continued the profession of his religion. Sometimes from curiosity he went to the ministrations of anabaptists,[2] to hear the preaching of peasants and artisans. He carried few books to Holland with him, but a Bible and the *Summa* of Thomas Aquinas were amongst them.[3] One of the recommendations of Egmond the Abbey was the free exercise there allowed to the Catholic religion. At Franeker his house was a small château, "separated by a moat from the rest of the town, where the mass could be said in safety."[4] And one motive in favour of accepting an invitation to England lay in the alleged leanings of Charles I. to the older church.

The best account of Descartes's mental history during his life in Holland is contained in his letters, which extend over the whole period, and are particularly frequent in the latter half. The majority of them are addressed to Mersenne, and deal with problems of physics, musical theory (in which he took a special interest), and mathematics. Several letters between 1643 and 1649 are addressed to the princess Elizabeth, the eldest daughter of the ejected elector palatine, who lived at The Hague, where her mother maintained the semblance of a royal court. The princess was obliged to quit Holland, but kept up a philosophical correspondence with Descartes. It is to her that the *Principles of Philosophy* were dedicated; and in her alone, according to Descartes, were united those generally separated talents for metaphysics and for mathematics which are so characteristically co-operative in the Cartesian system. Two Dutch friends, Constantijn Huygens (von Zuylichem), father of the more celebrated Huygens, and Hoogheland, figure amongst the correspondents, not to mention various savants, professors and churchmen (particularly Jesuits).

His residence in the Netherlands fell in the most prosperous and brilliant days of the Dutch state, under the stadtholdership of Frederick Henry (1625–1647). Abroad its navigators monopolized the commerce of the world, and explored unknown seas; at home the Dutch school of painting reached its acme in Rembrandt (1607–1669); and the philological reputation of the country was sustained by Grotius, Vossius and the elder Heinsius. And yet, though Rembrandt's "Nightwatch" is dated the very year after the publication of the *Meditations*, not a word in Descartes breathes of any work of art or historical learning. The contempt of aesthetics and erudition is characteristic of the most typical members of what is known as the Cartesian school, especially Malebranche. Descartes was not in any strict sense a reader. His wisdom grew mainly out of his own reflections and experiments. The story of his disgust when he found that Queen Christina devoted some time every day to the study of Greek under the tuition of Vossius is at least true in substance.[5] It gives no evidence of science, he remarks, to possess a tolerable knowledge of the Roman tongue, such as once was possessed by the populace of Rome.[6] In all his travels he studied only the phenomena of nature and human life. He was a spectator rather than an actor on the stage of the world. He entered the army, merely because the position gave a vantage-ground from which to make his observations. In the political interests which these contests involved he took no part; his favourite disciple, the princess Elizabeth, was the daughter of the banished king, against whom he had served in Bohemia; and Queen Christina, his second royal follower, was the daughter of Gustavus Adolphus.

Thus Descartes is a type of that spirit of science to which erudition and all the heritage of the past seem but elegant trifling. The science of Descartes was physics in all its branches, but especially as applied to physiology. Science, he says, may be compared to a tree; metaphysics is the root, physics is the trunk, and the three chief branches are mechanics, medicine and morals,—the three applications of our knowledge to the outward world, to the human body, and to the conduct of life.[7]

Such then was the work that Descartes had in view in Holland. His residence was generally divided into two parts—one his workshop for science, the other his reception-room for society. "Here are my books," he is reported to have told a visitor, as he pointed to the animals he had dissected. He worked hard at his book on refraction, and dissected the heads of animals in order to explain imagination and memory, which he considered physical processes.[8] But he was not a laborious student. "I can say with truth," he writes to the princess Elizabeth,[9] "that the principle which I have always observed in my studies, and which I believe has helped me most to gain what knowledge I have, has been never to spend beyond a very few hours daily in thoughts which occupy the imagination, and a very few hours yearly in those which occupy the understanding, and to give all the rest of my time to the relaxation of the senses and the repose of the mind." But his expectations from the study of anatomy and physiology went a long way. "The conservation of health," he writes in 1646, "has always been the principal end of my studies."[10] In 1629 he asks Mersenne to take care of himself "till I find out if there is any means of getting a medical theory based on infallible demonstrations, which is what I am now inquiring."[11] Astronomical inquiries in connexion with optics, meteorological phenomena, and, in a word, the whole field of natural laws, excited his desire to explain them. His own observation, and the reports of Mersenne, furnished his data. Of Bacon's demand for observation and collection of facts he is an imitator; and he wishes (in a letter of 1632) that "some one would undertake to give a history of celestial phenomena after the method of Bacon, and describe the sky exactly as it appears at present, without introducing a single hypothesis."[12]

He had several writings in hand during the early years of his residence in Holland, but the main work of this period was a physical doctrine of the universe which he termed *The World*. Shortly after his arrival he writes to Mersenne that it will probably be finished in 1633, but meanwhile asks him not to disclose the secret to his Parisian friends. Already anxieties appear as to the theological verdict upon two of his fundamental views—the infinitude of the universe, and the earth's rotation round the sun.[13] But towards the end of year 1633 we find him writing as follows:—"I had intended sending you my *World* as a New Year's gift, and a fortnight ago I was still minded to send you a fragment of the work, if the whole of it could not be transcribed in time. But I have just been at Leyden and Amsterdam to ask after Galileo's cosmical system as I imagined I had heard of its being printed last year in Italy. I was told that it had been printed, but that every copy had been at the same time burnt at Rome, and that Galileo had been himself condemned to some penalty."[14] He has also seen a copy of Galileo's condemnation at Liége (September 20, 1633), with the words "although he professes that the [Copernican] theory was only adopted by him as a hypothesis." His friend Beeckman lent him a copy of Galileo's work, which he glanced through in his usual manner with other men's books; he found it good, and "failing more in the points where it follows received opinions than where it diverges from them."[15] The consequence of these reports of the hostility of the church led him to abandon all thoughts of publishing. *The World* was consigned to his desk; and although doctrines in all essential respects the same constitute the physical portion of his *Principia*, it was not till after the death of Descartes that fragments of the work, including *Le Monde*, or a treatise on light, and the physiological tracts *L'Homme* and *La Formation du fœtus*, were given to the world by his admirer Claude Clerselier (1614–1684) in 1664. Descartes was not disposed to be a martyr; he had a sincere respect for the church, and had no wish to begin an open conflict with established doctrines.

In 1636 Descartes had resolved to publish some specimens of the fruits of his method, and some general observations on its

[1] *Œuvres*, viii. 59. [2] *Ib.* viii. 173. [3] *Ib.* viii. 181.
[4] *Ib.* vi. 123. [5] *Ib.* x. 375. [6] *Ib.* ix. 6.
[7] *Ib.* iii. 24. [8] *Ib.* vi. 234. [9] *Ib.* ix. 131.
[10] *Ib.* ix. 341. [11] *Ib.* vi. 89. [12] *Ib.* vi. 210.
[13] *Ib.* vi. 73. [14] *Ib.* vi. 239. [15] *Ib.* vi. 248.

nature which, under an appearance of simplicity, might sow the good seed of more adequate ideas on the world and man. "I should be glad," he says, when talking of a publisher,[1] "if the whole book were printed in good type, on good paper, and I should like to have at least 200 copies for distribution. The book will contain four essays, all in French, with the general title of 'Project of a Universal science, capable of raising our nature to its highest perfection; also Dioptrics, Meteors and Geometry, wherein the most curious matters which the author could select as a proof of the universal science which he proposes are explained in such a way that even the unlearned may understand them.'" The work appeared anonymously at Leiden (published by Jean Maire) in 1637, under the modest title of *Essais philosophiques*; and the project of a universal science becomes the *Discours de la méthode pour bien conduire sa raison et chercher la vérité dans les sciences*. In 1644 it appeared in a Latin version, revised by Descartes, as *Specimina philosophica*. A work so widely circulated by the author naturally attracted attention, but in France it was principally the mathematicians who took it up, and their criticisms were more pungent than complimentary. Fermat, Roberval and Desargues took exception in their various ways to the methods employed in the geometry, and to the demonstrations of the laws of refraction given in the Dioptrics and Meteors. The dispute on the latter point between Fermat and Descartes was continued, even after the philosopher's death, as late as 1662. In the youthful Dutch universities the effect of the essays was greater.

Spread of Cartesianism.

The first public teacher of Cartesian views was Henri Renery, a Belgian, who at Deventer and afterwards at Utrecht had introduced the new philosophy which he had learned from personal intercourse with Descartes. Renery only survived five years at Utrecht, and it was reserved for Heinrich Regius (van Roy)—who in 1638 had been appointed to the new chair of botany and theoretical medicine at Utrecht, and who visited Descartes at Egmond in order more thoroughly to learn his views—to throw down the gauntlet to the adherents of the old methods. With more eloquence than judgment, he propounded theses bringing into relief the points in which the new doctrines clashed with the old. The attack was opened by Gisbert Voët, foremost among the orthodox theological professors and clergy of Utrecht. In 1639 he published a series of arguments against atheism, in which the Cartesian views were not obscurely indicated as perilous for the faith, though no name was mentioned. Next year he persuaded the magistracy to issue an order forbidding Regius to travel beyond the received doctrine. The magisterial views seem to have prevailed in the professoriate, which formally in March 1642 expressed its disapprobation of the new philosophy as well as of its expositors. As yet Descartes was not directly attacked. Voët now issued, under the name of Martin Schoock, one of his pupils, a pamphlet with the title of *Methodus novae philosophiae Renati Descartes*, in which atheism and infidelity were openly declared to be the effect of the new teaching. Descartes replied to Voët directly in a letter, published at Amsterdam in 1643. He was summoned before the magistrates of Utrecht to defend himself against charges of irreligion and slander. What might have happened we cannot tell; but Descartes threw himself on the protection of the French ambassador and the prince of Orange, and the city magistrates, from whom he vainly demanded satisfaction in a dignified letter,[2] were snubbed by their superiors. About the same time (April 1645) Schoock was summoned before the university of Groningen, of which he was a member, and forthwith disavowed the more abusive passages in his book. So did the effects of the *odium theologicum*, for the meanwhile at least, die away.

Discourse of Method, and Meditations.

In the *Discourse of Method* Descartes had sketched the main points in his new views, with a mental autobiography which might explain their origin, and with some suggestions as to their applications. His second great work, *Meditations on the First Philosophy*, which had been begun soon after his settlement in the Netherlands, expounded in more detail the foundations of his system, laying especial emphasis on the priority of mind to body, and on the absolute and ultimate dependence of mind as well as body on the existence of God. In 1640 a copy of the work in manuscript was despatched to Paris, and Mersenne was requested to lay it before as many thinkers and scholars as he deemed desirable, with a view to getting their views upon its argument and doctrine. Descartes soon had a formidable list of objections to reply to. Accordingly, when the work was published at Paris in August 1641, under the title of *Meditationes de prima philosophia ubi de Dei existentia et animae immortalitate* (though it was in fact not the *immortality* but the *immateriality* of the mind, or, as the second edition described it, *animae humanae a corpore distinctio*, which was maintained), the title went on to describe the larger part of the book as containing various objections of learned men, with the replies of the author. These objections in the first edition are arranged under six heads: the first came from Caterus, a theologian of Louvain; the second and sixth are anonymous criticisms from various hands; whilst the third, fourth and fifth belong respectively to Hobbes, Arnauld and Gassendi. In the second edition appeared the seventh—objections from Père Bourdin, a Jesuit teacher of mathematics in Paris; and subsequently another set of objections, known as those of *Hyperaspistes*, was included in the collection of Descartes's letters. The anonymous objections are very much the statement of common-sense against philosophy; those of Caterus criticize the Cartesian argument from the traditional theology of the church; those of Arnauld are an appreciative inquiry into the bearings and consequences of the meditations for religion and morality; while those of Hobbes (*q.v.*) and Gassendi—both somewhat senior to Descartes and with a dogmatic system of their own already formed—are a keen assault upon the spiritualism of the Cartesian position from a generally "sensational" standpoint. The criticisms of the last two are the criticisms of a hostile school of thought; those of Arnauld are the difficulties of a possible disciple.

The Principia.

In 1644 the third great work of Descartes, the *Principia philosophiae*, appeared at Amsterdam. Passing briefly over the conclusions arrived at in the *Meditations*, it deals in its second, third and fourth parts with the general principles of physical science, especially the laws of motion, with the theory of vortices, and with the phenomena of heat, light, gravity, magnetism, electricity, &c., upon the earth. This work exhibits some curious marks of caution. Undoubtedly, says Descartes, the world was in the beginning created in all its perfection. "But yet as it is best, if we wish to understand the nature of plants or of men, to consider how they may by degrees proceed from seeds, rather than how they were created by God in the beginning of the world, so, if we can excogitate some extremely simple and comprehensible principles, out of which, as if they were seeds, we can prove that stars, and earth and all this visible scene could have originated, although we know full well that they never did originate in such a way, we shall in that way expound their nature far better than if we merely described them as they exist at present."[3] The Copernican theory is rejected in name, but retained in substance. The earth, or other planet, does not actually move round the sun; yet it is carried round the sun in the subtle matter of the great vortex, where it lies in equilibrium,—carried like the passenger in a boat, who may cross the sea and yet not rise from his berth.

In 1647 the difficulties that had arisen at Utrecht were repeated on a smaller scale at Leiden. There the Cartesian innovations had found a patron in Adrian Heerebord, and were openly discussed in theses and lectures. The theological professors took the alarm at passages in the *Meditations*; an attempt to prove the existence of God savoured, as they thought, of atheism and heresy. When Descartes complained to the authorities of this unfair treatment,[4] the only reply was an order by which all mention of the name of Cartesianism, whether favourable or adverse, was forbidden in the university. This was scarcely what Descartes wanted, and again he had to apply to the prince of Orange, whereupon the theologians were asked to behave with

[1] *Œuvres*, vi. 276. [2] *Ib.* ix. 250. [3] *Princip.* L. iii. S. 45. [4] *Œuvres*, x. 26.

civility, and the name of Descartes was no longer proscribed. But other annoyances were not wanting from unfaithful disciples and unsympathetic critics. The *Instantiae* of Gassendi appeared at Amsterdam in 1644 as a reply to the reply which Descartes had published of his previous objections; and the publication by Heinrich Regius of his work on physical philosophy (*Fundamenta physices*, 1646) gave the world to understand that he had ceased to be a thorough adherent of the philosophy which he had so enthusiastically adopted.

It was about 1648 that Descartes lost his friends Mersenne and Mydorge by death. The place of Mersenne as his Parisian representative was in the main taken by Claude Clerselier (the French translator of the Objections and Responses), whom he had become acquainted with in Paris. Through Clerselier he came to know Pierre Chanut, who in 1645 was sent as French ambassador to the court of Sweden. Queen Christina was not yet twenty, and took a lively if a somewhat whimsical interest in literary and philosophical culture. Through Chanut, with whom she was on terms of familiarity, she came to hear of Descartes, and a correspondence which the latter nominally carried on with the ambassador was in reality intended for the eyes of the queen. The correspondence took an ethical tone. It began with a long letter on love in all its aspects (February 1647),[1] a topic suggested by Chanut, who had been discussing it with the queen; and this was soon followed by another to Christina herself on the chief good. An essay on the passions of the mind (*Passions de l'âme*), which had been written originally for the princess Elizabeth, in development of some ethical views suggested by the *De vita beata* of Seneca, was enclosed at the same time for Chanut. It was a draft of the work published in 1650 under the same title. Philosophy, particularly that of Descartes, was becoming a fashionable *divertissement* for the queen and her courtiers, and it was felt that the presence of the sage himself was necessary to complete the good work of education. An invitation to the Swedish court was urged upon Descartes, and after much hesitation accepted; a vessel of the royal navy was ordered to wait upon him, and in September 1649 he left Egmond for the north.

The position on which he entered at Stockholm was unsuited for a man who wished to be his own master. The young queen wanted Descartes to draw up a code for a proposed academy of the sciences, and to give her an hour of philosophic instruction every morning at five. She had already determined to create him a noble, and begun to look out an estate in the lately annexed possessions of Sweden on the Pomeranian coast. But these things were not to be. His friend Chanut fell dangerously ill; and Descartes, who devoted himself to attend in the sick-room, was obliged to issue from it every morning in the chill northern air of January, and spend an hour in the palace library. The ambassador recovered, but Descartes fell a victim to the same disease, inflammation of the lungs. The last time he saw the queen was on the 1st of February 1650, when he handed to her the statutes he had drawn up for the proposed academy. On the 11th of February he died. The queen wished to bury him at the feet of the Swedish kings, and to raise a costly mausoleum in his honour; but these plans were overruled, and a plain monument in the Catholic cemetery was all that marked the place of his rest. Sixteen years after his death the French treasurer d'Alibert made arrangements for the conveyance of the ashes to his native land; and in 1667 they were interred in the church of Ste Geneviève du Mont, the modern Pantheon. In 1819, after being temporarily deposited in a stone sarcophagus in the court of the Louvre during the Revolutionary epoch, they were transferred to St Germain-des-Près, where they now repose between Montfaucon and Mabillon. A monument was raised to his memory at Stockholm by Gustavus III.; and a modern statue has been erected to him at Tours, with an inscription on the pedestal: "Je pense, donc je suis."

Death.

Descartes never married, and had little of the amorous in his temperament. He has alluded to a childish fancy for a young girl with a slight obliquity of vision; but he only mentions it *à propos* of the consequent weakness which led him to associate such a defect with beauty.[2] In person he was small, with large head, projecting brow, prominent nose, and eyes wide apart, with black hair coming down almost to his eyebrows. His voice was feeble. He usually dressed in black, with unobtrusive propriety.

Philosophy.—The end of all study, says Descartes, in one of his earliest writings, ought to be to guide the mind to form true and sound judgments on every thing that may be presented to it.[3] The sciences in their totality are but the intelligence of man; and all the details of knowledge have no value save as they strengthen the understanding. The mind is not for the sake of knowledge, but knowledge for the sake of the mind. This is the reassertion of a principle which the middle ages had lost sight of—that knowledge, if it is to have any value, must be intelligence, and not erudition.

But how is intelligence, as opposed to erudition, possible? The answer to that question is the method of Descartes. That idea of a method grew up with his study of geometry and arithmetic,—the only branches of knowledge which he would allow to be "made sciences." But they did not satisfy his demand for intelligence. "I found in them," he says, "different propositions on numbers of which, after a calculation, I perceived the truth; as for the figures, I had, so to speak, many truths put before my eyes, and many others concluded from them by analogy; but it did not seem to me that they told my mind with sufficient clearness why the things were as I was shown, and by what means their discovery was attained."[4] The mathematics of which he thus speaks included the geometry of the ancients, as it had been handed down to the modern world, and arithmetic with the developments it had received in the direction of algebra. The ancient geometry, as we know it, is a wonderful monument of ingenuity—a series of *tours de force*, in which each problem to all appearance stands alone, and, if solved, is solved by methods and principles peculiar to itself. Here and there particular curves, for example, had been obliged to yield the secret of their tangent; but the ancient geometers apparently had no consciousness of the general bearings of the methods which they so successfully applied. Each problem was something unique; the elements of transition from one to another were wanting; and the next step which mathematics had to make was to find some method of reducing, for instance, all curves to a common notation. When that was found, the solution of one problem would immediately entail the solution of all others which belonged to the same series as itself.

Mathematics.

The arithmetical half of mathematics, which had been gradually growing into algebra, and had decidedly established itself as such in the *Ad logisticen speciosam notae priores* of François Vieta (1540–1603), supplied to some extent the means of generalizing geometry. And the algebraists or arithmeticians of the 16th century, such as Luca Pacioli (Lucas de Borgo), Geronimo or Girolamo Cardano (1501–1576), and Niccola Tartaglia (1506–1559), had used geometrical constructions to throw light on the solution of particular equations. But progress was made difficult, in consequence of the clumsy and irregular nomenclature employed. With Descartes the use of exponents as now employed for denoting the powers of a quantity becomes systematic; and without some such step by which the homogeneity of successive powers is at once recognized, the binomial theorem could scarcely have been detected. The restriction of the early letters of the alphabet to known, and of the late letters to unknown, quantities is also his work. In this and other details he crowns and completes, in a form henceforth to be dominant for the language of algebra, the work of numerous obscure predecessors, such as Étienne de la Roche, Michael Stifel or Stiefel (1487–1567), and others.

Having thus perfected the instrument, his next step was to apply it in such a way as to bring uniformity of method into the isolated and independent operations of geometry. "I had no intention," [5] he says in the *Method*, "of attempting to master all

[1] *Œuvres*, x. 3.
[2] *Ib.* x. 53.
[3] *Regulae*, *Œuvres*, xi. 202.
[4] *Œuvres*, xi. 219.
[5] *Disc. de méthode*, part ii.

the particular sciences commonly called mathematics; but as I observed that, with all differences in their objects, they agreed in considering merely the various relations or proportions subsisting among these objects, I thought it best for my purpose to consider these relations in the most general form possible, without referring them to any objects in particular except such as would most facilitate the knowledge of them. Perceiving further, that in order to understand these relations I should sometimes have to consider them one by one, and sometimes only to bear them in mind or embrace them in the aggregate, I thought that, in order the better to consider them individually, I should view them as subsisting between straight lines, than which I could find no objects more simple, or capable of being more distinctly represented to my imagination and senses; and on the other hand that, in order to retain them in the memory or embrace an aggregate of many, I should express them by certain characters, the briefest possible." Such is the basis of the algebraical or modern analytical geometry. The problem of the curves is solved by their reduction to a problem of straight lines; and the locus of any point is determined by its distance from two given straight lines—the axes of co-ordinates. Thus Descartes gave to modern geometry that abstract and general character in which consists its superiority to the geometry of the ancients. In another question connected with this, the problem of drawing tangents to any curve, Descartes was drawn into a controversy with Pierre (de) Fermat (1601–1663), Gilles Persone de Roberval (1602–1675), and Girard Desargues (1593–1661). Fermat and Descartes agreed in regarding the tangent to a curve as a secant of that curve with the two points of intersection coinciding, while Roberval regarded it as the direction of the composite movement by which the curve can be described. Both these methods, differing from that now employed, are interesting as preliminary steps towards the method of fluxions and the differential calculus. In pure algebra Descartes expounded and illustrated the general methods of solving equations up to those of the fourth degree (and believed that his method could go beyond), stated the law which connects the positive and negative roots of an equation with the changes of sign in the consecutive terms, and introduced the method of indeterminate coefficients for the solution of equations.[1] These innovations have been attributed on inadequate evidence to other algebraists, *e.g.* William Oughtred (1575-1660) and Thomas Harriot (1560–1621).

The *Geometry* of Descartes, unlike the other parts of his essays, is not easy reading. It dashes at once into the middle of the subjects with the examination of a problem which had baffled the ancients, and seems as if it were tossed at the heads of the French geometers as a challenge. An edition of it appeared subsequently, with notes by his friend Florimond de Beaune (1601–1652), calculated to smooth the difficulties of the work. All along mathematics was regarded by Descartes rather as the envelope than the foundation of his method; and the "universal mathematical science" which he sought after was only the prelude of a universal science of all-embracing character.[2]

Descartes' method.

The method of Descartes rests upon the proposition that all the objects of our knowledge fall into series, of which the members are more or less known by means of one another. In every such series or group there is a dominant element, simple and irresoluble, the standard on which the rest of the series depends, and hence, so far as that group or series is concerned, absolute. The other members of the group are relative and dependent, and only to be understood as in various degrees subordinate to the primitive conception. The characteristic by which we recognize the fundamental element in a series is its intuitive or self-evident character; it is given by "the evident conception of a healthy and attentive mind so clear and distinct that no doubt is left."[3] Having discovered this prime or absolute member of the group, we proceed to consider the degrees in which the other members enter into relation with it. Here deduction comes into play to show the dependence of one term upon the others; and, in the case of a long chain of intervening links, the problem for intelligence is so to enunciate every element, and so to repeat the connexion that we may finally grasp all the links of the chain in one. In this way we, as it were, bring the causal or primal term and its remotest dependent immediately together, and raise a derivative knowledge into one which is primary and intuitive. Such are the four points of Cartesian method:—(1) Truth requires a clear and distinct conception of its object, excluding all doubt; (2) the objects of knowledge naturally fall into series or groups; (3) in these groups investigation must begin with a simple and indecomposable element, and pass from it to the more complex and relative elements; (4) an exhaustive and immediate grasp of the relations and interconnexion of these elements is necessary for knowledge in the fullest sense of that word.[4]

"There is no question," he says in anticipation of Locke and Kant, "more important to solve than that of knowing what human knowledge is and how far it extends." "This is a question which ought to be asked at least once in their lives by all who seriously wish to gain wisdom. The inquirer will find that the first thing to know is intellect, because on it depends the knowledge of all other things. Examining next what immediately follows the knowledge of pure intellect, he will pass in review all the other means of knowledge, and will find that they are two (or three), the imagination and the senses (and the memory). He will therefore devote all his care to examine and distinguish these three means of knowledge; and seeing that truth and error can, properly speaking, be only in the intellect, and that the two other modes of knowledge are only occasions, he will carefully avoid whatever can lead him astray."[5] This separation of intellect from sense, imagination and memory is the cardinal precept of the Cartesian logic; it marks off clear and distinct (*i.e.* adequate and vivid) from obscure, fragmentary and incoherent conceptions.

Fundamental principles of philosophy.

The *Discourse of Method* and the *Meditations* apply what the *Rules for the Direction of the Mind* had regarded in particular instances to our conceptions of the world as a whole. They propose, that is, to find a simple and indecomposable point, or absolute element, which gives to the world and thought their order and systematization. The grandeur of this attempt is perhaps unequalled in the annals of philosophy. The three main steps in the argument are the veracity of our thought when that thought is true to itself, the inevitable uprising of thought from its fragmentary aspects in our habitual consciousness to the infinite and perfect existence which God is, and the ultimate reduction of the material universe to extension and local movement. These are the central dogmas of logic, metaphysics and physics, from which start the subsequent inquiries of Locke, Leibnitz and Newton. They are also the direct antitheses to the scepticism of Montaigne and Pascal, to the materialism of Gassendi and Hobbes, and to the superstitious anthropomorphism which defaced the reawakening sciences of nature. Descartes laid down the lines on which modern philosophy and science were to build. But himself no trained metaphysician, and unsusceptible to the lessons of history, he gives but fragments of a system which are held together, not by their intrinsic consistency, but by the vigour of his personal conviction transcending the weaknesses and collisions of his several arguments. "All my opinions," he says, "are so conjoined, and depend so closely upon one another, that it would be impossible to appropriate one without knowing them all."[6] Yet every disciple of Cartesianism seems to disprove the dictum by his example.

The very moment when we begin to think, says Descartes, when we cease to be merely receptive, when we draw back and fix our attention on any point whatever of our belief,—that moment doubt begins. If we even stop for an instant to ask ourselves how a word ought to be spelled, the deeper we ponder that one word by itself the more hopeless grows the hesitation. The doubts thus awakened must not be stifled, but pressed systematically on to the point, if such a point there be, where doubt confutes itself. The doubt as to the details is natural; it

[1] *Géométrie*, book iii. [2] *Œuvres*, xi. 224. [3] *Ib.* xi. 212.
[4] *Disc. de méthode*, part ii. [5] *Œuvres*, xi. 243. [6] *Ib.* vii. 381.

is no less natural to have recourse to authority to silence the doubt. The remedy proposed by Descartes is (while not neglecting our duties to others, ourselves and God) to let doubt range unchecked through the whole fabric of our customary convictions. One by one they refuse to render any reasonable account of themselves; each seems a mere chance, and the whole tends to elude us like a mirage which some malignant power creates for our illusion. Attacked in detail, they vanish one after another into as many teasing spectra of uncertainty. We are seeking from them what they cannot give. But when we have done our worst in unsettling them, we come to an ultimate point in the fact that it is *we* who are doubting, *we* who are thinking. We may doubt that we have hands or feet, that we sleep or wake, and that there is a world of material things around us; but we cannot doubt that we are doubting. We are certain that we are thinking, and in so far as we are thinking we are. *Je pense, donc je suis.* In other words, the criterion of truth is a clear and distinct conception, excluding all possibility of doubt.

Cogito ergo sum.

The fundamental point thus established is the veracity of consciousness when it does not go beyond itself, or does not postulate something which is external to itself. At this point Gassendi arrested Descartes and addressed his objections to him as pure intelligence,—*O mens!* But even this *mens*, or mind, is but a point—we have found no guarantee as yet for its continuous existence. The analysis must be carried deeper, if we are to gain any further conclusions.

Amongst the elements of our thought there are some which we can make and unmake at our pleasure; there are others which come and go without our wish; there is also a third class which is of the very essence of our thinking, and which dominates our conceptions. We find that all our ideas of limits, sorrows and weaknesses presuppose an infinite, perfect and ever-blessed something beyond them and including them,—that all our ideas, in all their series, converge to one central idea, in which they find their explanation. The formal fact of thinking is what constitutes our being; but this thought leads us back, when we consider its concrete contents, to the necessary pre-supposition on which our ideas depend, the permanent cause on which they and we as conscious beings depend. We have therefore the idea of an infinite, perfect and all-powerful being—an idea which cannot be the creation of ourselves, and must be given by some being who really possesses all that we in idea attribute to him. Such a being he identifies with God. But the ordinary idea of God can scarcely be identified with such a conception. "The majority of men," he says himself, "do not think of God as an infinite and incomprehensible being, and as the sole author from whom all things depend; they go no further than the letters of his name."[1] "The vulgar almost imagine him as a finite thing."

Nature of God.

The God of Descartes is not merely the creator of the material universe; he is also the father of all truth in the intellectual world. "The metaphysical truths," he says, "styled eternal have been established by God, and, like the rest of his creatures, depend entirely upon him. To say that these truths are independent of him is to speak of God as a Jupiter or a Saturn,—to subject him to Styx and the Fates."[2] The laws of thought, the truths of number, are the decrees of God. The expression is anthropomorphic, no less than the dogma of material creation: but it is an attempt to affirm the unity of the intellectual and the material world. Descartes establishes a philosophic monotheism,—by which the medieval polytheism of substantial forms, essences and eternal truths fades away before God, who is the ruler of the intellectual world no less than of the kingdom of nature and of grace.

To attach a clear and definite meaning to the Cartesian doctrine of God, to show how much of it comes from the Christian theology and how much from the logic of idealism, how far the conception of a personal being as creator and preserver mingles with the pantheistic conception of an infinite and perfect something which is all in all, would be to go beyond Descartes and to ask for a solution of difficulties of which he was scarcely aware. It seems impossible to deny that the tendency of his principles and his arguments is mainly in the line of a metaphysical absolute, as the necessary completion and foundation of all being and knowledge. Through the truthfulness of that God as the author of all truth he derives a guarantee for our perceptions in so far as these are clear and distinct. And it is in guaranteeing the veracity of our clear and distinct conceptions that the value of his deduction of God seems in his own estimate to rest. All conceptions which do not possess these two attributes—of being vivid in themselves and discriminated from all others—cannot be true. But the larger part of our conceptions are in such a predicament. We think of things not in the abstract elements of the things themselves, but in connexion with, and in language which presupposes, other things. Our idea of body, *e.g.*, involves colour and weight, and yet when we try to think carefully, and without assuming anything, we find that we cannot attach any distinct idea to these terms when applied to body. In truth therefore these attributes do not belong to body at all; and if we go on in the same way testing the received qualities of matter, we shall find that in the last resort we understand nothing by it but extension, with the secondary and derivative characters of divisibility and mobility.

But it would again be useless to ask how extension as the characteristic attribute of matter is related to mind which thinks, and how God is to be regarded in reference to extension. The force of the universe is swept up and gathered in God, who communicates motion to the parts of extension, and sustains that motion from moment to moment; and in the same way the force of mind has really been concentrated in God. Every moment one expects to find Descartes saying with Hobbes that man's thought has created God, or with Spinoza and Malebranche that it is God who really thinks in the apparent thought of man. After all, the metaphysical theology of Descartes, however essential in his own eyes, serves chiefly as the ground for constructing his theory of man and of the universe. His fundamental hypothesis relegates to God all forces in their ultimate origin. Hence the world is left open for the free play of mechanics and geometry. The disturbing conditions of will, life and organic forces are eliminated from the problem; he starts with the clear and distinct idea of extension, figured and moved, and thence by mathematical laws he gives a hypothetical explanation of all things. Such explanation of physical phenomena is the main problem of Descartes, and it goes on encroaching upon territories once supposed proper to the mind. Descartes began with the certainty that we are thinking beings; that region remains untouched; but up to its very borders the mechanical explanation of nature reigns unchecked.

The physical theory, in its earlier form in *The World*, and later in the *Principles of Philosophy* (which the present account follows), rests upon the metaphysical conclusions of the *Meditations*. It proposes to set forth the genesis of the existing universe from principles which can be plainly understood, and according to the acknowledged laws of the transmission of movement. The idea of force is one of those obscure conceptions which originate in an obscure region, in the sense of muscular power. The true physical conception is motion, the ultimate ground of which is to be sought in God's infinite power. Accordingly the quantity of movement in the universe, like its mover, can neither increase nor diminish. The only circumstance which physics has to consider is the transference of movement from one particle to another, and the change of its direction. Man himself cannot increase the sum of motion; he can only alter its direction. The whole conception of force may disappear from a theory of the universe; and we can adopt a geometrical definition of motion as the shifting of one body from the neighbourhood of those bodies which immediately touch it, and which are assumed to be at rest, to the neighbourhood of other bodies. Motion, in short, is strictly locomotion, and nothing else.

Physical theory.

Descartes has laid down three laws of nature, and seven secondary laws regarding impact. The latter are to a large extent incorrect. The first law affirms that every body, so far as it is altogether unaffected by extraneous causes, always

[1] *Œuvres*, vi. 132. [2] *Ib.* vi. 109.

perseveres in the same state of motion or of rest; and the second law that simple or elementary motion is always in a straight line.[1] These doctrines of inertia, and of the composite character of curvilinear motion, were scarcely apprehended even by Kepler or Galileo; but they follow naturally from the geometrical analysis of Descartes.

Extended body has no limits to its extent, though the power of God has divided it in lines discriminating its parts in endless ways. The infinite universe is infinitely full of matter. Empty space, as distinguished from material extension, is a fictitious abstraction. There is no such thing really as a vacuum, any more than there are atoms or ultimate indivisible particles. In both these doctrines of *à priori* science Descartes has not been subverted, but, if anything, corroborated by the results of experimental physics; for the so-called atoms of chemical theory already presuppose, from the Cartesian point of view, certain aggregations of the primitive particles of matter. Descartes regards matter as uniform in character throughout the universe; he anticipates, as it were, from his own transcendental ground, the revelations of spectrum analysis as applied to the sun and stars. We have then to think of a full universe of matter (and matter = extension) divided and figured with endless variety, and set (and kept) in motion by God; and any sort of division, figure and motion will serve the purposes of our supposition as well as another. "Scarcely any supposition,"[2] he says, "can be made from which the same result, though possibly with greater difficulty, might not be deduced by the same laws of nature; for since, in virtue of these laws, matter successively assumes all the forms of which it is capable, if we consider these forms in order, we shall at one point or other reach the existing form of the world, so that no error need here be feared from a false supposition." As the movement of one particle in a closely-packed universe is only possible if all other parts move simultaneously, so that the last in the series steps into the place of the first; and as the figure and division of the particles varies in each point in the universe, there will inevitably at the same instant result throughout the universe an innumerable host of more or less circular movements, and of vortices or whirlpools of material particles varying in size and velocity. Taking for convenience a limited portion of the universe, we observe that in consequence of the circular movement, the particles of matter have their corners pared off by rubbing against each other; and two species of matter thus arise,—one consisting of small globules which continue their circular motion with a (centrifugal) tendency to fly off from the centre as they swing round the axis of rotation, while the other, consisting of the fine dust—the filings and parings of the original particles—gradually becoming finer and finer, and losing its velocity, tends (centripetally) to accumulate in the centre of the vortex, which has been gradually left free by the receding particles of globular matter. This finer matter which collects in the centre of each vortex is the *first* matter of Descartes—it constitutes the sun or star. The spherical particles are the *second* matter of Descartes, and their tendency to propel one another from the centre in straight lines towards the circumference of each vortex is what gives rise to the phenomenon of light radiating from the central star. This second matter is atmosphere or firmament, which envelops and revolves around the central accumulation of first matter.

Theory of vortices.

A third form of matter is produced from the original particles. As the small filings produced by friction seek to pass through the interstices between the rapidly revolving spherical particles in the vortex, they are detained and become twisted and channelled in their passage, and when they reach the edge of the inner ocean of solar dust they settle upon it as the froth and foam produced by the agitation of water gathers upon its surface. These form what we term spots in the sun. In some cases they come and go, or dissolve into an aether round the sun; but in other cases they gradually increase until they form a dense crust round the central nucleus. In course of time the star, with its expansive force diminished, suffers encroachments from the neighbouring vortices, and at length they catch it up. If the velocity of the decaying star be greater than that of any part of the vortex which has swept it up, it will ere long pass out of the range of that vortex, and continue its movement from one to another. Such a star is a comet. But in other cases the encrusted star settles in that portion of the revolving vortex which has a velocity equivalent to its own, and so continues to revolve in the vortex, wrapped in its own firmament. Such a reduced and impoverished star is a planet; and the several planets of our solar system are the several vortices which from time to time have been swept up by the central sun-vortex. The same considerations serve to explain the moon and other satellites. They too were once vortices, swallowed up by some other, which at a later day fell a victim to the sweep of our sun.

Such in mere outline is the celebrated theory of *vortices*, which for about twenty years after its promulgation reigned supreme in science, and for much longer time opposed a tenacious resistance to rival doctrines. It is one of the grandest hypotheses which ever have been formed to account by mechanical processes for the movements of the universe. While chemistry rests in the acceptanceof ultimate heterogeneous elements, the vortex-theory assumed uniform matter through the universe, and reduced cosmical physics to the same principles as regulate terrestrial phenomena. It ended the old Aristotelian distinction between the sphere beneath the moon and the starry spaces beyond. It banished the spirits and genii, to which even Kepler had assigned the guardianship of the planetary movements; and, if it supposes the globular particles of the envelope to be the active force in carrying the earth round the sun, we may remember that Newton himself assumed an aether for somewhat similar purposes. The great argument on which the Cartesians founded their opposition to the Newtonian doctrine was that attraction was an occult quality, not wholly intelligible by the aid of mere mechanics. The Newtonian theory is an analysis of the elementary movements which in their combination determine the planetary orbits, and gives the formula of the proportions according to which they act. But the Cartesian theory, like the later speculations of Kant and Laplace, proposes to give a hypothetical explanation of the circumstances and motions which in the normal course of things led to the state of things required by the law of attraction. In the judgment of D'Alembert the Cartesian theory was the best that the observations of the age admitted; and "its explanation of gravity was one of the most ingenious hypotheses which philosophy ever imagined." That the explanation fails in detail is undoubted: it does not account for the ellipticity of the planets; it would place the sun, not in one focus, but in the centre of the ellipse; and it would make gravity directed towards the centre only under the equator. But these defects need not blind us to the fact that this hypothesis made the mathematical progress of Hooke, Borelli and Newton much more easy and certain. Descartes professedly assumed a simplicity in the phenomena which they did not present. But such a hypothetical simplicity is the necessary step for solving the more complex problems of nature. The danger lies not in forming such hypotheses, but in regarding them as final, or as more than an attempt to throw light upon our observation of the phenomena. In doing what he did, Descartes actually exemplified that reduction of the processes of nature to mere transposition of the particles of matter, which in different ways was a leading idea in the minds of Bacon, Hobbes and Gassendi. The defects of Descartes lie rather in his apparently imperfect apprehension of the principle of movements uniformly accelerated which his contemporary Galileo had illustrated and insisted upon, and in the indistinctness which attaches to his views of the transmission of motion in cases of impact. It should be added that the modern theory of vortex-atoms (Lord Kelvin's) to explain the constitution of matter has but slight analogy with Cartesian doctrine, and finds a parallel, if anywhere, in a modification of that doctrine by Malebranche.

Besides the last two parts of the *Principles of Philosophy*, the physical writings of Descartes include the *Dioptrics* and *Meteors*, as well as passages in the letters. His optical investigations are perhaps the subject in which he most contributed to the progress

[1] *Princip.* part ii. 37. [2] *Ib.* part iii. 47.

of science; and the lucidity of exposition which marks his *Dioptrics* stands conspicuous even amid the generally luminous[1] style of his works. Its object is a practical one, to determine by scientific considerations the shape of lens best adapted to improve the capabilities of the telescope, which had been invented not long before. The conclusions at which he arrives have not been so useful as he imagined, in consequence of the mechanical difficulties. But the investigation by which he reaches them has the merit of first prominently publishing and establishing the law of the refraction of light. Attempts have been made, principally founded on some remarks of Huygens, to show that Descartes had learned the principles of refraction from the manuscript of a treatise by Willebrord Snell, but the facts are uncertain; and, so far as Descartes founds his optics on any one, it is probably on the researches of Kepler. In any case the discovery is to some extent his own, for his proof of the law is founded upon the theory that light is the propagation of the aether in straight lines from the sun or luminous body to the eye (see LIGHT). Thus he approximates to the wave theory of light, though he supposed that the transmission of light was instantaneous. The chief of his other contributions to optics was the explanation of the rainbow—an explanation far from complete, since the unequal refrangibility of the rays of light was yet undiscovered—but a decided advance upon his predecessors, notably on the *De radiis visus et lucis* (1611) of Marc-Antonio de Dominis, archbishop of Spalato.

Optical theories.

If Descartes had contented himself with thus explaining the phenomena of gravity, heat, magnetism, light and similar forces by means of the molecular movements of his vortices, even such a theory would have excited admiration. But he did not stop short in the region of what is usually termed physics. Chemistry and biology are alike swallowed up in the one science of physics, and reduced to a problem of mechanism. This theory, he believed, would afford an explanation of every phenomenon whatever, and in nearly every department of knowledge he has given specimens of its power. But the most remarkable and daring application of the theory was to account for the phenomena of organic life, especially in animals and man. "If we possessed a thorough knowledge," he says,[1] "of all the parts of the seed of any species of animal (*e.g.* man), we could from that alone, by reasons entirely mathematical and certain, deduce the whole figure and conformation of each of its members, and, conversely, if we knew several peculiarities of this conformation, we could from these deduce the nature of its seed." The organism in this way is regarded as a machine, constructed from the particles of the seed, which in virtue of the laws of motion have arranged themselves (always under the governing power of God) in the particular animal shape in which we see them. The doctrine of the circulation of the blood, which Descartes adopted from Harvey, supplied additional arguments in favour of his mechanical theory, and he probably did much to popularize the discovery. A fire without light, compared to the heat which gathers in a haystack when the hay has been stored before it was properly dry—heat, in short, as an agitation of the particles—is the motive cause of the contraction and dilatations of the heart. Those finer particles of the blood which become extremely rarefied during this process pass off in two directions—one portion, and the least important in the theory, to the organs of generation, the other portion to the cavities of the brain. There not merely do they serve to nourish the organ, they also give rise to a fine ethereal flame or wind through the action of the brain upon them, and thus form the so-called "animal" spirits. From the brain these spirits are conveyed through the body by means of the nerves, regarded by Descartes as tubular vessels, resembling the pipes conveying the water of a spring to act upon the mechanical appliances in an artificial fountain. The nerves conduct the animal spirits to act upon the muscles, and in their turn convey the impressions of the organs to the brain.

Man and the animals as thus described are compared to automata, and termed machines. The vegetative and sensitive souls which the Aristotelians had introduced to break the leap between inanimate matter and man are ruthlessly swept away; only one soul, the rational, remains, and that is restricted to man. One hypothesis supplants the various principles of life; the rule of absolute mechanism is as complete in the animal as in the cosmos. Reason and thought, the essential quality of the soul, do not belong to the brutes; there is an impassable gulf fixed between man and the lower animals. The only sure sign of reason is the power of language—*i.e.* of giving expression to general ideas; and language in that sense is not found save in man. The cries of animals are but the working of the curiously-contrived machine, in which, when one portion is touched in a certain way, the wheels and springs concealed in the interior perform their work, and, it may be, a note supposed to express joy or pain is evolved; but there is no consciousness or feeling. "The animals act naturally and by springs, like a watch."[2] "The greatest of all the prejudices we have retained from our infancy is that of believing that the beasts think."[3] If the beasts can properly be said to see at all, "they see as we do when our mind is distracted and keenly applied elsewhere; the images of outward objects paint themselves on the retina, and possibly even the impressions made in the optic nerves determine our limbs to different movements, but we feel nothing of it all, and move as if we were automata."[4] The sentience of the animal to the lash of his tyrant is not other than the sensitivity of the plant to the influences of light and heat. It is not much comfort to learn further from Descartes that "he denies life to no animal, but makes it consist in the mere heat of the heart. Nor does he deny them feeling in so far as it depends on the bodily organs."[5]

Automatism.

Descartes, with an unusual fondness for the letter of Scripture, quotes oftener than once in support of this monstrous doctrine the dictum, "the blood is the life"; and he remarks, with some sarcasm possibly, that it is a comfortable theory for the eaters of animal flesh. And the doctrine found acceptance among some whom it enabled to get rid of the difficulties raised by Montaigne and those who allowed more difference between animal and animal than between the higher animals and man. It also encouraged vivisection—a practice common with Descartes himself.[6] The recluses of Port Royal seized it eagerly, discussed automatism, dissected living animals in order to show to a morbid curiosity the circulation of the blood, were careless of the cries of tortured dogs, and finally embalmed the doctrine in a syllogism of their logic,—No matter thinks; every soul of beast is matter: therefore no soul of beast thinks.

But whilst all the organic processes in man go on mechanically, and though by reflex action he may repel attack unconsciously, still the first affirmation of the system was that man was essentially a thinking being; and, while we retain this original dictum, it must not be supposed that the mind is a mere spectator, or like the boatman in the boat. Of course a unity of nature is impossible between mind and body so described. And yet there is a unity of composition, a unity so close that the compound is "really one and in a sense indivisible." You cannot in the actual man cut soul and body asunder; they interpenetrate in every member. But there is one point in the human frame—a point midway in the brain, single and free, which may in a special sense be called the seat of the mind. This is the so-called conarion, or pineal gland, where in a minimized point the mind on one hand and the vital spirits on the other meet and communicate. In that gland the mystery of creation is concentrated; thought meets extension and directs it; extension moves towards thought and is perceived. Two clear and distinct ideas, it seems, produce an absolute mystery. Mind, driven from the field of extension, erects its last fortress in the pineal gland. In such a state of despair and destitution there is no hope for spiritualism, save in God; and Clauberg, Geulincx and Malebranche all take refuge under the shadow of his wings to escape the tyranny of extended matter.

Relation of mind and body.

In the psychology of Descartes there are two fundamental

[1] *Œuvres*, iv. 494.

[1] *Ib.* ix. 426. [2] *Ib.* x. 204. [3] *Ib.* vi. 339. [4] *Ib.* x. 208. [5] *Ib.* iv. 452 and 454.

modes of thought,—perception and volition. "It seems to me," he says, "that in receiving such and such an idea the mind is passive, and that it is active only in volition; that its ideas are put in it partly by the objects which touch the senses, partly by the impressions in the brain, and partly also by the dispositions which have preceded in the mind itself and by the movements of its will."[1] The will, therefore, as being more originative, has more to do with true or false judgments than the understanding. Unfortunately, Descartes is too lordly a philosopher to explain distinctly what either understanding or will may mean. But we gather that in two directions our reason is bound up with bodily conditions, which make or mar it, according as the will, or central energy of thought, is true to itself or not. In the range of perception, intellect is subjected to the material conditions of sense, memory and imagination; and in infancy, when the will has allowed itself to assent precipitately to the conjunctions presented to it by these material processes, thought has become filled with obscure ideas. In the moral sphere the passions or emotions (which Descartes reduces to the six primitive forms of admiration, love, hatred, desire, joy and sadness) are the perceptions or sentiments of the mind, caused and maintained by some movement of the vital spirits, but specially referring to the mind only. The presentation of some object of dread, for example, to the eye has or may have a double effect. On one hand the animal spirits "reflected"[2] from the image formed on the pineal gland proceed through the nervous tubes to make the muscles turn the back and lift the feet, so as to escape the cause of the terror. Such is the reflex and mechanical movement independent of the mind. But, on the other hand, the vital spirits cause a movement in the gland by which the mind perceives the affection of the organs, learns that something is to be loved or hated, admired or shunned. Such perceptions dispose the mind to pursue what nature dictates as useful. But the estimate of goods and evils which they give is indistinct and unsatisfactory. The office of reason is to give a true and distinct appreciation of the values of goods and evils; or firm and determinate judgments touching the knowledge of good and evil are our proper arms against the influence of the passions.[3] We are free, therefore, through knowledge: *ex magna luce in intellectu sequitur magna propensio in voluntate*, and *omnis peccans est ignorans*. "If we clearly see that what we are doing is wrong, it would be impossible for us to sin, so long as we saw it in that light."[4] Thus the highest liberty, as distinguished from mere indifference, proceeds from clear and distinct knowledge, and such knowledge can only be attained by firmness and resolution, *i.e.* by the continued exercise of the will. Thus in the perfection of man, as in the nature of God, will and intellect must be united. For thought, will is as necessary as understanding. And innate ideas therefore are mere capacities or tendencies,—possibilities which apart from the will to think may be regarded as nothing at all.

Psychology.

The Cartesian School.—The philosophy of Descartes fought its first battles and gained its first triumphs in the country of his adoption. In his lifetime his views had been taught in Utrecht and Leiden. In the universities of the Netherlands and of lower Germany, as yet free from the conservatism of the old-established seats of learning, the new system gained an easy victory over Aristotelianism, and, as it was adapted for lectures and examinations, soon became almost as scholastic as the doctrines it had supplanted. At Leiden, Utrecht, Groningen, Franeker, Breda, Nimeguen, Harderwyk, Duisburg and Herborn, and at the Catholic university of Louvain, Cartesianism was warmly expounded and defended in seats of learning, of which many are now left desolate, and by adherents whose writings have for the most part long lost interest for any but the antiquary.

The Cartesianism of Holland was a child of the universities, and its literature is mainly composed of commentaries upon the original texts, of theses discussed in the schools, and of systematic expositions of Cartesian philosophy for the benefit of the student. Three names stand out in this Cartesian professoriate,—Wittich, Clauberg and Geulincx. Christoph Wittich (1625–1687), professor at Duisburg and Leiden, is a representative of the moderate followers who professed to reconcile the doctrines of their school with the faith of Christendom and to refute the theology of Spinoza. Johann Clauberg (*q.v.*) commented clause by clause upon the *Meditations* of Descartes; but he specially claims notice for his work *De corporis et animae in homine conjunctione*, where he maintains that the bodily movements are merely procatarctic causes (*i.e.* antecedents, but not strictly causes) of the mental action, and sacrifices the independence of man to the omnipotence of God. The same tendency is still more pronounced in Arnold Geulincx (*q.v.*). With him the reciprocal action of mind and body is altogether denied; they resemble two clocks, so made by the artificer as to strike the same hour together. The mind can act only upon itself; beyond that limit, the power of God must intervene to make any seeming interaction possible between body and soul. Such are the half-hearted attempts at consistency in Cartesian thought, which eventually culminate in the pantheism of Spinoza (see CARTESIANISM).

Holland.

Descartes occasionally had not scrupled to interpret the Scriptures according to his own tenets, while still maintaining, when their letter contradicted him, that the Bible was not meant to teach the sciences. Similar tendencies are found amongst his followers. Whilst Protestant opponents put him in the list of atheists like Vanini, and the Catholics held him as dangerous as Luther or Calvin, there were zealous adherents who ventured to prove the theory of vortices in harmony with the book of Genesis. It was this rationalistic treatment of the sacred writings which helped to confound the Cartesians with the allegorical school of John Cocceius, as their liberal doctrines in theology justified the vulgar identification of them with the heresies of Socinian and Arminian. The chief names in this advanced theology connected with Cartesian doctrine are Ludwig Meyer, the friend and editor of Spinoza, author of a work termed *Philosophia scripturae interpres* (1666); Balthasar Bekker, whose *World Bewitched* helped to discredit the superstitious fancies about the devil; and Spinoza, whose *Tractatus theologico-politicus* is in some respects the classical type of rational criticism up to the present day. Against this work and the *Ethics* of Spinoza the orthodox Cartesians (who were in the majority), no less than sceptical hangers-on like Bayle, raised an all but universal howl of reprobation, scarcely broken for about a century.

In France Cartesianism won society and literature before it penetrated into the universities. Clerselier (the friend of Descartes and his literary executor), his son-in-law Rohault (who achieved that relationship through his Cartesianism), and others, opened their houses for readings to which the intellectual world of Paris—its learned professors not more than the courtiers and the fair sex,—flocked to hear the new doctrines explained, and possibly discuss their value. Grand seigneurs, like the prince of Condé, the duc de Nevers and the marquis de Vardes, were glad to vary the monotony of their feudal castles by listening to the eloquent rehearsals of Malebranche or Regis. And the salons of Mme de Sévigné, of her daughter Mme de Grignan, and of the duchesse de Maine for a while gave the questions of philosophy a place among the topics of polite society, and furnished to Molière the occasion of his *Femmes savantes*. The château of the duc de Luynes, the translator of the *Meditations*, was the home of a Cartesian club, that discussed the questions of automatism and of the composition of the sun from filings and parings, and rivalled Port Royal in its vivisections. The cardinal de Retz in his leisurely age at Commercy found amusement in presiding at disputations between the more moderate Cartesians and Dom Robert Desgabets, who interpreted Descartes in an original way of his own. Though rejected by the Jesuits, who found peripatetic formulae a faithful weapon against the enemies of the church, Cartesianism was warmly adopted by the Oratory, which saw in Descartes something of St Augustine, by Port Royal, which discovered a connexion between the new system and Jansenism, and by some amongst the Benedictines and the order of Ste Geneviève.

France.

[1] *Œuvres*, ix. 166.
[2] *Passions de l'âme*, 36.
[3] *Ib.* 48.
[4] *Œuvres*, ix. 170.

The popularity which Cartesianism thus gained in the social and literary circles of the capital was largely increased by the labours of Pierre-Sylvain Regis (1632–1707). On his visit to Toulouse in 1665, with a mission from the Cartesian chiefs, his lectures excited boundless interest; ladies threw themselves with zeal and ability into the study of philosophy; and Regis himself was made the guest of the civic corporation. In 1671 scarcely less enthusiasm was roused in Montpellier; and in 1680 he opened a course of lectures at Paris, with such acceptance that hearers had to take their seats in advance. Regis, by removing the paradoxes and adjusting the metaphysics to the popular powers of apprehension, made Cartesianism popular, and reduced it to a regular system.

But a check was at hand. Descartes, in his correspondence with the Jesuits, had shown an almost cringing eagerness to have their powerful organization on his side. Especially he had written to Père Mesland, one of the order, to show how the Catholic doctrine of the eucharist might be made compatible with his theories of matter. But his undue haste to arrange matters with the church only served to compromise him more deeply. Unwise admirers and malicious opponents exaggerated the theological bearings of his system in this detail; and the efforts of the Jesuits succeeded in getting the works of Descartes, in November 1663, placed upon the index of prohibited books,—*donec corrigantur*. Thereupon the power of church and state enforced by positive enactments the passive resistance of old institutions to the novel theories. In 1667 the oration at the interment was forbidden by royal order. In 1669, when the chair of philosophy at the Collège Royal fell vacant, one of the four selected candidates had to sustain a thesis against "the pretended new philosophy of Descartes." In 1671 the archbishop of Paris, by the king's order, summoned the heads of the university to his presence, and enjoined them to take stricter measures against philosophical novelties dangerous to the faith. In 1673 a decree of the parlement against Cartesian and other unlicensed theories was on the point of being issued, and was only checked in time by the appearance of a burlesque mandamus against the intruder Reason, composed by Boileau and some of his brother-poets. Yet in 1675 the university of Angers was empowered to repress all Cartesian teaching within its domain, and actually appointed a commission charged to look for such heresies in the theses and the students' note-books of the college of Anjou belonging to the Oratory. In 1677 the university of Caen adopted not less stringent measures against Cartesianism. And so great was the influence of the Jesuits, that the congregation of St Maur, the canons of Ste Geneviève, and the Oratory laid their official ban on the obnoxious doctrines. From the real or fancied *rapprochements* between Cartesianism and Jansenism, it became for a while impolitic, if not dangerous, to avow too loudly a preference for Cartesian theories. Regis was constrained to hold back for ten years his *System of Philosophy*; and when it did appear, in 1690, the name of Descartes was absent from the title-page. There were other obstacles besides the mild persecutions of the church. Pascal and other members of Port Royal openly expressed their doubts about the place allowed to God in the system; the adherents of Gassendi met it by resuscitating atoms; and the Aristotelians maintained their substantial forms as of old; the Jesuits argued against the arguments for the being of God, and against the theory of innate ideas; whilst Pierre Daniel Huet (1630–1721), bishop of Avranches, once a Cartesian himself, made a vigorous onslaught on the contempt in which his former comrades held literature and history, and enlarged on the vanity of all human aspirations after rational truth.

The greatest and most original of the French Cartesians was Malebranche (*q.v.*). His *Recherche de la vérité*, in 1674, was the baptism of the system into a theistic religion which borrowed its imagery from Augustine; it brought into prominence the metaphysical base which Louis Delaforge, Jacques Rohault and Regis had neither cared for nor understood. But this doctrine was a criticism and a divergence, no less than a consequence, from the principles in Descartes; and it brought upon Malebranche the opposition, not merely of the Cartesian physicists, but also of Arnauld, Fénelon and Bossuet, who found, or hoped to find, in the *Meditations*, as properly understood, an ally for theology. Popular enthusiasm, however, was with Malebranche, as twenty years before it had been with Descartes; he was the fashion of the day; and his disciples rapidly increased both in France and abroad.

In 1705 Cartesianism was still subject to prohibitions from the authorities; but in a project of new statutes, drawn up for the faculty of arts at Paris in 1720, the *Method* and *Meditations* of Descartes were placed beside the *Organon* and the *Metaphysics* of Aristotle as text-books for philosophical study. And before 1725, readings, both public and private, were given from Cartesian texts in some of the Parisian colleges. But when this happened, Cartesianism was no longer either interesting or dangerous; its theories, taught as ascertained and verified truths, were as worthless as the systematic verbiage which preceded them. Already antiquated, it could not resist the wit and raillery with which Voltaire, in his *Lettres sur les Anglais* (1728), brought against it the principles and results of Locke and Newton. The old Cartesians, Jean Jacques Dortous de Mairan (1678–1771) and especially Fontenelle, with his *Théorie des tourbillons* (1752), struggled in vain to refute Newton by styling attraction an occult quality. Fortunately the Cartesian method had already done its service, even where the theories were rejected. The Port Royalists, Pierre Nicole (1625–1695) and Antoine Arnauld (1612–1694), had applied it to grammar and logic; Jean Domat or Daumat (1625–1696) and Henri François Daugesseau (1668–1751) to jurisprudence; Fontenelle, Charles Perrault (1628–1703) and Jean Terrasson (1670–1750) to literary criticism, and a worthier estimate of modern literature. Though it never ceased to influence individual thinkers, it had handed on to Condillac its popularity with the masses. A Latin abridgment of philosophy, dated 1784, tells us that the innate ideas of Descartes are founded on no arguments, and are now universally abandoned. The ghost of innate ideas seems to be all that it had left.

In Germany a few Cartesian lecturers taught at Leipzig and Halle, but the system took no root, any more than in Switzerland, where it had a brief reign at Geneva after 1669. In Italy the effects were more permanent. What is termed the iatro-mechanical school of medicine, with G. A. Borelli (1608–1679) as its most notable name, entered in a way on the mechanical study of anatomy suggested by Descartes, but was probably much more dependent upon the positive researches of Galileo. At Naples there grew up a Cartesian school, of which the best known members are Michel Angelo Fardella (1650–1708) and Cardinal Gerdil (1718–1802), both of whom, however, attached themselves to the characteristic views of Malebranche. *Germany.*

In England Cartesianism took but slight hold. Henry More, who had given it a modified sympathy in the lifetime of the author, became its opponent in later years; and Cudworth differed from it in most essential points. Antony Legrand, from Douai, attempted to introduce it into Oxford, but failed. He is the author of several works, amongst others a system of Cartesian philosophy, where a chapter on "Angels" revives the methods of the schoolmen. His chief opponent was Samuel Parker (1640–1688), bishop of Oxford, who, in his attack on the irreligious novelties of the Cartesian, treats Descartes as a fellow-criminal in infidelity with Hobbes and Gassendi. Rohault's version of the Cartesian physics was translated into English; and Malebranche found an ardent follower in John Norris (1667–1711). Of Cartesianism towards the close of the 17th century the only remnants were an overgrown theory of vortices, which received its death-blow from Newton, and a dubious phraseology anent innate ideas, which found a witty executioner in Locke. *England.*

For an account of the metaphysical doctrines of Descartes, in their connexions with Malebranche and Spinoza, see CARTESIANISM.

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(1713); in French in 13 vols. (Paris, 1724–1729), republished by Victor Cousin (Paris, 1824–1826) in 11 vols., and again under the authority of the minister of public instruction by C. Adam and P. Tannery (1897 foll.). These include his so-called posthumous works. *The Rules for the Direction of the Mind*, *The Search for Truth by the Light of Nature*, and other unimportant fragments, published (in Latin) in 1701. In 1859–1860 Foucher de Careil published in two parts some unedited writings of Descartes from copies taken by Leibnitz from the original papers. Six editions of the *Opera philosophica* appeared at Amsterdam between 1650 and 1678; a two-volume edition at Leipzig in 1843; there are also French editions, *Œuvres philosophiques*, by A. Garnier, 3 vols. (1834–1835), and L. Aimé-Martin (1838) and *Œuvres morales et philosophiques* by Aimé-Martin with an introduction on life and works by Amedée Prévost (Paris, 1855); *Œuvres choisies* (1850) by Jules Simon. A complete French edition of the collected works was begun in the Romance Library (1907 foll.). German translations by J. H. von Kirchmann under the title *Philosophische Werke* (with biography, &c., Berlin, 1868; 2nd ed., 1882–1891), by Kuno Fischer, *Die Hauptschriften zur Grundlegung seiner Philosophie* (1863), with introduction by Ludwig Fischer (1892). There are also numerous editions and translations of separate works, especially the *Method*, in French, German, Italian, Spanish and Hungarian. There are English translations by J. Veitch, *Method, Meditations and Selections from the Principles* (1850–1853; 11th ed., 1897; New York, 1899); by H. A. P. Torrey (New York, 1892).

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DESCHAMPS, ÉMILE (1791–1871), French poet and man of letters, was born at Bourges on the 20th of February 1791. The son of a civil servant, he adopted his father's career, but as early as 1812 he distinguished himself by an ode, *La Paix conquise*, which won the praise of Napoleon. In 1818 he collaborated with Henri de Latouche in two verse comedies, *Selmours de Florian* and *Le Tour de faveur*. He and his brother were among the most enthusiastic disciples of the *cénacle* gathered round Victor Hugo, and in July 1823 Émile founded with his master the *Muse française*, which during the year of its existence was the special organ of the romantic party. His *Etudes françaises et étrangères* (1828) were preceded by a preface which may be regarded as one of the manifestos of the romanticists. The versions of Shakespeare's *Romeo and Juliet* (1839) and of *Macbeth* (1844), important as they were in the history of the romantic movement, were never staged. He was the author of several libretti, among which may be mentioned the *Roméo et Juliette* of Berlioz. The list of his more important works is completed by his two volumes of stories, *Contes physiologiques* (1854) and *Réalités fantastiques* (1854). He died at Versailles in April 1871. His *Œuvres complètes* were published in 1872–1874 (6 vols.).

His brother, Antoine François Marie, known as ANTONY DESCHAMPS, was born in Paris on the 12th of March 1800 and died at Passy on the 29th of October 1869. Like his brother, he was an ardent romanticist, but his production was limited by a nervous disorder, which has left its mark on his melancholy work. He translated the *Divina Commedia* in 1829, and his poems, *Dernières Paroles* and *Résignation*, were republished with his brother's in 1841.

DESCHAMPS, EUSTACHE, called MOREL (1346?–1406?), French poet, was born at Vertus in Champagne about 1346. He studied at Reims, where he is said to have received some lessons in the art of versification from Guillaume de Machaut, who is stated to have been his uncle. From Reims he proceeded about 1360 to the university of Orleans to study law and the seven liberal arts. He entered the king's service as royal messenger about 1367, and was sent on missions to Bohemia, Hungary and Moravia. In 1372 he was made *huissier d'armes* to Charles V. He received many other important offices, was *bailli* of Valois, and afterwards of Senlis, squire to the Dauphin, and governor of Fismes. In 1380 his patron, Charles V., died, and in the same year the English burnt down his house at Vertus. In his childhood he had been an eye-witness of the English invasion of 1358; he had been present at the siege of Reims and seen the march on Chartres; he had witnessed the signing of the treaty of Bretigny; he was now himself a victim of the English fury. His violent hatred of the English found vent in numerous appeals to carry the war into England, and in the famous prophecy [1] that England would be destroyed so thoroughly that no one should be able to point to her ruins. His own misfortunes and the miseries of France embittered his temper. He complained continually of poverty, railed against women and lamented the woes of his country. His last years were spent on his *Miroir de mariage*, a satire of 13,000 lines against women, which contains some real comedy. The mother-in-law of French farce has her prototype in the *Miroir*.

The historical and patriotic poems of Deschamps are of much greater value. He does not, like Froissart, cast a glamour over the miserable wars of the time but gives a faithful picture of the anarchy of France, and inveighs ceaselessly against the heavy taxes, the vices of the clergy and especially against those who enrich themselves at the expense of the people. The terrible ballad with the refrain "*Sà, de l'argent; sà, de l'argent*" is typical of his work. Deschamps excelled in the use of the ballade and the chant royal. In each of these forms he was the greatest master of his time. In ballade form he expressed his regret for the death of Du Guesclin, who seems to have been the only man except his patron, Charles V., for whom he ever felt any admiration. One of his ballades (No. 285) was sent with a copy of his works to Geoffrey Chaucer, whom he addresses with the words:—

> "Tu es d'amours mondains dieux en Albie
> Et de la Rose en la terre Angélique."

Deschamps was the author of an *Art poétique*, with the title of *L'Art de dictier et de fere chancons, balades, virelais et rondeaulx*. Besides giving rules for the composition of the kinds of verse mentioned in the title he enunciates some curious theories on poetry. He divides music into music proper and poetry. Music proper he calls artificial on the ground that everyone could by dint of study become a musician; poetry he calls natural because

[1] "*De la prophécie Merlin sur la destruction d'Angleterre qui doit briefadvenir*" (*Œuvres*, No. 211).

he says it is not an art that can be acquired but a gift. He lays immense stress on the harmony of verse, because, as was the fashion of his day, he practically took it for granted that all poetry was to be sung.

The work of Deschamps marks an important stage in the history of French poetry. With him and his contemporaries the long, formless narrations of the *trouvères* give place to complicated and exacting kinds of verse. He was perhaps by nature a moralist and satirist rather than a poet, and the force and truth of his historical pictures gives him a unique place in 14th-century poetry. M. Raynaud fixes the date of his death in 1406, or at latest, 1407. Two years earlier he had been relieved of his charge as *bailli* of Senlis, his plain-spoken satires having made him many enemies at court.

His *Œuvres complètes* were edited (10 vols., 1878–1901) for the *Société des anciens textes français* by Queux de Saint-Hilaire and Gaston Raynaud. A supplementary volume consists of an Introduction by G. Raynaud. See also Dr E. Hoeppner, *Eustache Deschamps* (Strassburg, 1904).

DESCHANEL, PAUL EUGÈNE LOUIS (1856–), French statesman, son of Émile Deschanel (1819–1904), professor at the Collège de France and senator, was born at Brussels, where his father was living in exile (1851–1859), owing to his opposition to Napoleon III. Paul Deschanel studied law, and began his career as secretary to Deshayes de Marcère (1876), and to Jules Simon (1876–1877). In October 1885 he was elected deputy for Eure and Loire. From the first he took an important place in the chamber, as one of the most notable orators of the Progressist Republican group. In January 1896 he was elected vice-president of the chamber, and henceforth devoted himself to the struggle against the Left, not only in parliament, but also in public meetings throughout France. His addresses at Marseilles on the 26th of October 1896, at Carmaux on the 27th of December 1896, and at Roubaix on the 10th of April 1897, were triumphs of clear and eloquent exposition of the political and social aims of the Progressist party. In June 1898 he was elected president of the chamber, and was re-elected in 1901, but rejected in 1902. Nevertheless he came forward brilliantly in 1904 and 1905 as a supporter of the law on the separation of church and state. He was elected a member of the French Academy in 1899, his most notable works being *Orateurs et hommes d'état* (1888), *Figures de femmes* (1889), *La Décentralization* (1895), *La Question sociale* (1898).

DES CLOIZEAUX, ALFRED LOUIS OLIVIER LEGRAND (1817–1897), French mineralogist, was born at Beauvais, in the department of Oise, on the 17th of October 1817. He became professor of mineralogy at the École Normale Supérieure and afterwards at the Musée d'Histoire Naturelle in Paris. He studied the geysers of Iceland, and wrote also on the classification of some of the eruptive rocks; but his main work consisted in the systematic examination of the crystals of numerous minerals, in researches on their optical properties and on the subject of polarization. He wrote specially on the means of determining the different felspars. He was awarded the Wollaston medal by the Geological Society of London in 1886. He died in May 1897. His best-known books are *Leçons de cristallographie* (1861); *Manuel de minéralogie* (2 vols., Paris, 1862, 1874 and 1893).

DESCLOIZITE, a rare mineral species consisting of basic lead and zinc vanadate, $(Pb, Zn)_2(OH)VO_4$, crystallizing in the orthorhombic system and isomorphous with olivenite. It was discovered by A. Damour in 1854, and named by him in honour of the French mineralogist Des Cloizeaux. It occurs as small prismatic or pyramidal crystals, usually forming drusy crusts and stalactitic aggregates; also as fibrous encrusting masses with a mammillary surface. The colour is deep cherry-red to brown or black, and the crystals are transparent or translucent with a greasy lustre; the streak is orange-yellow to brown; specific gravity 5·9 to 6·2; hardness 3½. A variety known as cuprodescloizite is dull green in colour; it contains a considerable amount of copper replacing zinc and some arsenic replacing vanadium. Descloizite occurs in veins of lead ores in association with pyromorphite, vanadinite, wulfenite, &c. Localities are the Sierra de Cordoba in Argentina, Lake Valley in Sierra county, New Mexico, Arizona, Phoenixville in Pennsylvania, and Kappel (Eisen-Kappel) near Klagenfurt in Carinthia.

Other names which have been applied to this species are vanadite, tritochorite and ramirite; the uncertain vanadates eusynchite, araeoxene and dechenite are possibly identical with it.

DESCRIPTIVE POETRY, the name given to a class of literature, which may be defined as belonging mainly to the 16th, 17th and 18th centuries in Europe. From the earliest times, all poetry which was not subjectively lyrical was apt to indulge in ornament which might be named descriptive. But the critics of the 17th century formed a distinction between the representations of the ancients and those of the moderns. We find Boileau emphasizing the statement that, while Virgil *paints*, Tasso *describes*. This may be a useful indication for us in defining not what should, but what in practice has been called "descriptive poetry." It is poetry in which it is not imaginative passion which prevails, but a didactic purpose, or even something of the instinct of a sublimated auctioneer. In other words, the landscape, or architecture, or still life, or whatever may be the object of the poet's attention, is not used as an accessory, but is itself the centre of interest. It is, in this sense, not correct to call poetry in which description is only the occasional ornament of a poem, and not its central subject, descriptive poetry. The landscape or still life must fill the canvas, or, if human interest is introduced, that must be treated as an accessory. Thus, in the *Hero and Leander* of Marlowe and in the *Alastor* of Shelley, description of a very brilliant kind is largely introduced, yet these are not examples of what is technically called "descriptive poetry," because it is not the strait between Sestos and Abydos, and it is not the flora of a tropical glen, which concentrates the attention of the one poet or of the other, but it is an example of physical passion in the one case and of intellectual passion in the other, which is diagnosed and dilated on. On the other hand Thomson's *Seasons*, in which landscape takes the central place, and Drayton's *Polyolbion*, where everything is sacrificed to a topographical progress through Britain, are strictly descriptive.

It will be obvious from this definition that the danger ahead of all purely descriptive poetry is that it will lack intensity, that it will be frigid, if not dead. Description for description's sake, especially in studied verse, is rarely a vitalized form of literature. It is threatened, from its very conception, with languor and coldness; it must exercise an extreme art or be condemned to immediate sterility. Boileau, with his customary intelligence, was the first to see this, and he thought that the danger might be avoided by care in technical execution. His advice to the poets of his time was:—

> "Soyez riches et pompeux dans vos descriptions;
> C'est-là qu'il faut des vers étaler l'élégance,"

and:—

> "De figure sans nombre égayez votre ouvrage;
> Que toute y fasse aux yeux une riante image,"

and in verses of brilliant humour he mocked the writer who, too full of his subject, and describing for description's sake, will never quit his theme until he has exhausted it:—

> "Fuyez de ces auteurs l'abondance stérile
> Et ne vous chargez point d'un détail inutile."

This is excellent advice, but Boileau's humorous sallies do not quite meet the question whether such purely descriptive poetry as he criticizes is legitimate at all.

In England had appeared the famous translation (1592–1611), by Josuah Sylvester, of the *Divine Weeks and Works* of Du Bartas, containing such lines as those which the juvenile Dryden admired so much:—

> "But when the winter's keener breath began
> To crystallize the Baltic ocean,
> To glaze the lakes, and bridle up the floods,
> And perriwig with wool the bald-pate woods."

There was also the curious physiological epic of Phineas Fletcher, *The Purple Island* (1633). But on the whole it was not until French influences had made themselves felt on English poetry,

that description, as Boileau conceived it, was cultivated as a distinct art. The *Cooper's Hill* (1642) of Sir John Denham may be contrasted with the less ambitious *Penshurst* of Ben Jonson, and the one represents the new no less completely than the other does the old generation. If, however, we examine *Cooper's Hill* carefully, we perceive that its aim is after all rather philosophical than topographical. The Thames is described indeed, but not very minutely, and the poet is mainly absorbed in moral reflections. Marvell's long poem on the beauties of Nunappleton comes nearer to the type. But it is hardly until we reach the 18th century that we arrive, in English literature, at what is properly known as descriptive poetry. This was the age in which poets, often of no mean capacity, began to take such definite themes as a small country estate (Pomfret's *Choice*, 1700), the cultivation of the grape (Gay's *Wine*, 1708), a landscape (Pope's *Windsor Forest*, 1713), a military manœuvre (Addison's *Campaign*, 1704), the industry of an apple-orchard (Philip's *Cyder*, 1708) or a piece of topography (Tickell's *Kensington Gardens*, 1722), as the sole subject of a lengthy poem, generally written in heroic or blank verse. These *tours de force* were supported by minute efforts in miniature-painting, by touch applied to touch, and were often monuments of industry, but they were apt to lack personal interest, and to suffer from a general and deplorable frigidity. They were infected with the faults which accompany an artificial style; they were monotonous, rhetorical and symmetrical, while the uniformity of treatment which was inevitable to their plan rendered them hopelessly tedious, if they were prolonged to any great extent.

This species of writing had been cultivated to a considerable degree through the preceding century, in Italy and (as the remarks of Boileau testify) in France, but it was in England that it reached its highest importance. The classic of descriptive poetry, in fact, the specimen which the literature of the world presents which must be considered as the most important and the most successful, is *The Seasons* (1726–1730) of James Thomson (*q.v.*). In Thomson, for the first time, a poet of considerable eminence appeared, to whom external nature was all sufficient, and who succeeded in conducting a long poem to its close by a single appeal to landscape, and to the emotions which it directly evokes. Coleridge, somewhat severely, described *The Seasons* as the work of a good rather than of a great poet, and it is an indisputable fact that, at its very best, descriptive poetry fails to awaken the highest powers of the imagination. A great part of Thomson's poem is nothing more nor less than a skilfully varied catalogue of natural phenomena. The famous description of twilight in "the fading many-coloured woods" of autumn may be taken as an example of the highest art to which purely descriptive poetry has ever attained. It is obvious, even here, that the effect of these rich and sonorous lines, in spite of the splendid effort of the artist, is monotonous, and leads us up to no final crisis of passion or rapture. Yet Thomson succeeds, as few other poets of his class have succeeded, in producing nobly-massed effects and comprehensive beauties such as were utterly unknown to his predecessors. He was widely imitated in England, especially by Armstrong, by Akenside, by Shenstone (in *The Schoolmistress*, 1742), by the anonymous author of *Albania*, 1737, and by Goldsmith (in *The Deserted Village*, 1770). No better example of the more pedestrian class of descriptive poetry could be found than the last-mentioned poem, with its minute and Dutch-like painting:—

> "How often have I paused on every charm:
> The sheltered cot, the cultivated farm;
> The never-failing brook, the busy mill,
> The decent church that topped the neighbouring hill:
> The hawthorn-bush, with seats beneath the shade,
> For talking age and whispering lovers made."

On the continent of Europe the example of Thomson was almost immediately fruitful. Four several translations of *The Seasons* into French contended for the suffrages of the public, and J. F. de Saint-Lambert (1716–1803) imitated Thomson in *Les Saisons* (1769), a poem which enjoyed popularity for half a century, and of which Voltaire said that it was the only one of its generation which would reach posterity. Nevertheless, as Madame du Deffand told Walpole, Saint-Lambert is "*froid, fade et faux*," and the same may be said of J. A. Roucher (1745–1794), who wrote *Les Mois* in 1779, a descriptive poem famous in its day. The Abbé Jacques Delille (1738–1813), perhaps the most ambitious descriptive poet who has ever lived, was treated as a Virgil by his contemporaries; he published *Les Géorgiques* in 1769, *Les Jardins* in 1782, and *L'Homme des champs* in 1803, but he went furthest in his brilliant, though artificial, *Trois règnes de la nature* (1809), which French critics have called the masterpiece of this whole school of descriptive poetry. Delille, however, like Thomson before him, was unable to avoid monotony and want of coherency. Picture follows picture, and no progress is made. The satire of Marie Joseph Chénier, in his famous and witty *Discours sur les poèmes descriptifs*, brought the vogue of this species of poetry to an end.

In England, again, Wordsworth, who treated the genius of Thomson with unmerited severity, revived descriptive poetry in a form which owed more than Wordsworth realized to the model of *The Seasons*. In *The Excursion* and *The Prelude*, as well as in many of his minor pieces, Wordsworth's philosophical and moral intentions cannot prevent us from perceiving the large part which pure description takes; and the same may be said of much of the early blank verse of S. T. Coleridge. Since their day, however, purely descriptive poetry has gone more and more completely out of fashion, and its place has been taken by the richer and directer effects of such prose as that of Ruskin in English, or of Fromentin and Pierre Loti in French. It is almost impossible in descriptive verse to obtain those vivid and impassioned appeals to the imagination which are of the very essence of genuine poetry, and it is unlikely that descriptive poetry, as such, will again take a prominent place in living literature. (E. G.)

DESERT, a term somewhat loosely employed to describe those parts of the land surface of the earth which do not produce sufficient vegetation to support a human population. Few areas of large extent in any part of the world are absolutely devoid of vegetation, and the transition from typical desert conditions is often very gradual and ill-defined. ("Desert" comes from Lat. *deserere*, to abandon; distinguish "desert," merit, and "dessert," fruit eaten after dinner, from *de* and *servir*, to serve.)

Deserts are conveniently divided into two classes according to the causes which give rise to the desert conditions. In "cold deserts" the want of vegetation is wholly due to the prevailing low temperature, while in "hot deserts" the surface is unproductive because, on account of high temperature and deficient rainfall, evaporation is largely in excess of precipitation. Cold deserts accordingly occur in high latitudes (see TUNDRA and POLAR REGIONS). Hot desert conditions are primarily found along the tropical belts of high atmospheric pressure in which the conditions of warmth and dryness are most fully realized, and on their equatorial sides, but the zonal arrangement is considerably modified in some regions by the monsoonal influence of elevated land. Thus we have in the northern hemisphere the Sahara desert, the deserts of Arabia, Iran, Turan, Takla Makan and Gobi, and the desert regions of the Great Basin in North America; and in the southern hemisphere the Kalahari desert in Africa, the desert of Australia, and the desert of Atacama in South America. Where the line of elevated land runs east and west, as in Asia, the desert belt tends to be displaced into higher latitudes, and where the line runs north and south, as in Africa, America and Australia, the desert zone is cut through on the windward side of the elevation and the arid conditions intensified on the lee side. Desert conditions also arise from local causes, as in the case of the Indian desert situated in a region inaccessible to either of the two main branches of the south-west monsoon.

Although rivers rising in more favoured regions may traverse deserts on their way to the sea, as in the case of the Nile and the Colorado, the fundamental physical condition of an arid area is that it contributes nothing to the waters of the ocean. The rainfall chiefly occurs in violent cloudbursts, and the soluble matter in the soil is carried down by intermittent streams to salt lakes

around which deposits are formed as evaporation takes place. The land forms of a desert are exceedingly characteristic. Surface erosion is chiefly due to rapid changes of temperature through a wide range, and to the action of wind transferring sand and dust, often in the form of "dunes" resembling the waves of the sea. Dry valleys, narrow and of great depth, with precipitous sides, and ending in "cirques," are probably formed by the intense action of the occasional cloud-bursts.

When water can be obtained and distributed over an arid region by irrigation, the surface as a rule becomes extremely productive. Natural springs give rise to oases at intervals and make the crossing of large deserts possible. Where a river crosses a desert at a level near that of the general surface, irrigation can be carried on with extremely profitable results, as has been done in the valley of the Nile and in parts of the Great Basin of North America; in cases, however, where the river has cut deeply and flows far below the general surface, irrigation is too expensive. Much has been done in parts of Australia by means of artesian wells.

For a general account of deserts see Professor Johannes Walther, *Das Gesetz der Wüstenbildung* (Berlin, 1900), in which many references to other original authorities will be found. (H. N. D.)

DESERTION, the act of forsaking or abandoning; more particularly, the wilful abandonment of an employment or of duty, in violation of a legal or moral obligation.

The offence of naval or military desertion is constituted when a man absents himself with the intention either of not returning or of escaping some important service, such as embarkation for foreign service, or service in aid of the civil power. In the United Kingdom desertion has always been recognized by the civil law, and until 1827 (7 & 8 Geo. IV. c. 28) was a felony punishable by death. It was subsequently dealt with by the various Mutiny Acts, which were replaced by the Army Act 1881, renewed annually by the Army (Annual) Act. By § 12 of the act every person subject to military law who deserts or attempts to desert, or who persuades or procures any person to desert, shall, on conviction by court martial, if he committed the offence when on active service or under orders for active service, be liable to suffer death, or such less punishment as is mentioned in the act. When the offence is committed under any other circumstances, the punishment for the first offence is imprisonment, and for the second or any subsequent offence penal servitude or such less punishment as is mentioned in the act. § 44 contains a scale of punishments, and §§ 175-184 an enumeration of persons subject to military law. By § 153 any person who persuades a soldier to desert or aids or assists him or conceals him is liable, on conviction, to be imprisoned, with or without hard labour, for not more than six months. § 154 makes provision for the apprehension of deserters. § 161 lays down that where a soldier has served continuously in an exemplary manner for not less than three years in any corps of regular forces he is not to be tried or punished for desertion which has occurred before the commencement of the three years. Desertion from the regular forces can only be tried by a military court, but in the case of the militia and reserve forces desertion can be tried by a civil court. The Army Act of 1881 made a welcome distinction between actual desertion, as defined at the commencement of this article, and the quitting one regiment in order to enlist in another. This offence is now separately dealt with as fraudulent enlistment; formerly, it was termed "desertion and fraudulent enlistment," and the statistics of desertion proper were consequently and erroneously magnified. The gross total of desertions in the British Army in an average year (1903–1904) was nearly 4000, or 1·4 % of the average strength of the army, but owing to men rejoining from desertion, fraudulent enlistment, &c., the net loss was no more than 1286, *i.e.* less than ·5 %. The army of the United States suffers very severely from desertion, and very few deserters rejoin or are recaptured (see *Journal of the Roy. United Service Inst.*, December 1905, p. 1469). In the year 1900–1901, 3110 men deserted (4·3 % of average strength); in 1901–1902, 4667 (or 5·9 %); in 1904–1905, 6553 (or 6·8 %); and in 1905–1906, 6258 out of less than 60,000 men, or 7·4 %.

In all armies desertion while on active service is punishable by death; on the continent of Europe, owing to the system of compulsory service, desertion is infrequent, and takes place usually when the deserter wishes to leave his country altogether. It was formerly the practice in the English army to punish a man convicted of desertion by tattooing on him the letter "D" to prevent his re-enlistment, but this has been long abandoned in deference to public opinion, which erroneously adopted the idea that the "marking" was effected by red-hot irons or in some other manner involving torture. The Navy Discipline Act 1866, and the Naval Deserters Act 1847, contain similar provisions to the Army Act of 1881 for dealing with desertions from the navy. In the United States navy the term "straggling" is applied to absence without leave, where the probability is that the person does not intend to desert. The United States government offers a monetary reward of between $20 and $30 for the arrest and delivery of deserters from the army and navy.

In the British merchant service the offence of desertion is defined as the abandonment of duty by quitting the ship before the termination of the engagement, without justification, and with the intention of not returning.

Desertion is also the term applied to the act by which a man abandons his wife and children, or either of them. Desertion of a wife is a matrimonial offence; under the Matrimonial Causes Act 1857, a decree of judicial separation may be obtained in England by either husband or wife on the ground of desertion, without cause, for two years and upwards (see also DIVORCE).

For the desertion of children see CHILDREN, LAW RELATING TO; INFANT. (T. A. I.)

DES ESSARTS, EMMANUEL ADOLPHE (1839–), French poet and man of letters, was born at Paris on the 5th of February 1839. His father, Alfred Stanislas Langlois des Essarts (d. 1893), was a poet and novelist of considerable reputation. The son was educated at the École Normale Supérieure, and became a teacher of rhetoric and finally professor of literature at Dijon and at Clermont. His works are: *Poésies parisiennes* (1862), a volume of light verse on trifling subjects; *Les Élévations* (1864), philosophical poems; *Origines de la poésie lyrique en France au XVI^e siècle* (1873); *Du génie de Chateaubriand* (1876); *Poèmes de la Révolution* (1879); *Pallas Athéné* (1887); *Portraits de maîtres* (1888), &c.

DESFONTAINES, RENÉ LOUICHE (1750–1833), French botanist, was born at Tremblay (Ile-et-Vilaine) on the 14th of February 1750. After graduating in medicine at Paris, he was elected a member of the Academy of Sciences in 1783. In the same year he set out for North Africa, on a scientific exploring expedition, and on his return two years afterwards brought with him a large collection of plants, animals, &c., comprising, it is said, 1600 species of plants, of which about 300 were described for the first time. In 1786 he was nominated to the post of professor at the Jardin des Plantes, vacated in his favour by his friend, L. G. Lemonnier. His great work, *Flora Atlantica sive historia plantarum quae in Atlante, agro Tunetano et Algeriensi crescunt*, was published in 2 vols. 4to in 1798, and he produced in 1804 a *Tableau de l'école botanique du muséum d'histoire naturelle de Paris*, of which a third edition appeared in 1831, under the new title *Catalogus plantarum horti regii Parisiensis*. He was also the author of many memoirs on vegetable anatomy and physiology, descriptions of new genera and species, &c., one of the most important being a "Memoir on the Organization of the Monocotyledons." He died at Paris on the 16th of November 1833. His Barbary collection was bequeathed to the Muséum d'Histoire Naturelle, and his general collection passed into the hands of the English botanist, Philip Barker Webb.

DESFORGES, PIERRE JEAN BAPTISTE CHOUDARD (1746–1806), French dramatist and man of letters, natural son of Dr Antoine Petit, was born in Paris on the 15th of September 1746. He was educated at the Collège Mazarin and the Collège de Beauvais, and at his father's desire began the study of medicine. Dr Petit's death left him dependent on his own resources, and after appearing on the stage of the Comédie Italienne in Paris he joined a troupe of wandering actors, whom he served in the

capacity of playwright. He married an actress, and the two spent three years in St Petersburg, where they were well received. In 1782 he produced at the Comédie Italienne an adaptation of Fielding's novel with the title *Tom Jones à Londres*. His first great success was achieved with *L'Epreuve villageoise* (1785) to the music of Grétry. *La Femme jalouse*, a five-act comedy in verse (1785), *Joconde* (1790) for the music of Louis Jadin, *Les Époux divorcés* (1799), a comedy, and other pieces followed. Desforges was one of the first to avail himself of the new facilities afforded under the Revolution for divorce and re-marriage. The curious record of his own early indiscretions in *Le Poète, ou mémoires d'un homme de lettres écrits par lui-même* (4 vols., 1798) is said to have been undertaken at the request of Madame Desforges. He died in Paris on the 13th of August 1806.

DESGARCINS, MAGDELEINE MARIE [LOUISE] (1769–1797), French actress, was born at Mont Dauphin (Hautes Alpes). In her short career she became one of the greatest of French tragédiennes, the associate of Talma, with whom she nearly always played. Her début at the Comédie Française occurred on the 24th of May 1788, in *Bajazet*, with such success that she was at once made *sociétaire*. She was one of the actresses who left the Comédie Française in 1791 for the house in the rue Richelieu, soon to become the Théâtre de la République, and there her triumphs were no less—in *King Lear*, *Othello*, La Harpe's *Mélanie et Virginie*, &c. Her health, however, failed, and she died insane, in Paris, on the 27th of October 1797.

DESHAYES, GÉRARD PAUL (1795–1875), French geologist and conchologist, was born at Nancy on the 13th of May 1797, his father at that time being professor of experimental physics in the École Centrale of the department of la Meurthe. He studied medicine at Strassburg, and afterwards took the degree of *bachelier ès lettres* in Paris in 1821; but he abandoned the medical profession in order to devote himself to natural history. For some time he gave private lessons on geology, and subsequently became professor of natural history in the Muséum d'Histoire Naturelle. He was distinguished for his researches on the fossil mollusca of the Paris Basin and of other Tertiary areas. His studies on the relations of the fossil to the recent species led him as early as 1829 to conclusions somewhat similar to those arrived at by Lyell, to whom Deshayes rendered much assistance in connexion with the classification of the Tertiary system into Eocene, Miocene and Pliocene. He was one of the founders of the Société Géologique de France. In 1839 he began the publication of his *Traité élémentaire de conchyliologie*, the last part of which was not issued until 1858. In the same year (1839) he went to Algeria for the French Government, and spent three years in explorations in that country. His principal work, which resulted from the collections he made, *Mollusques de l'Algérie*, was issued (incomplete) in 1848. In 1870 the Wollaston medal of the Geological Society of London was awarded to him. He died at Boran on the 9th of June 1875. His publications included *Description des coquilles fossiles des environs de Paris* (2 vols. and atlas, 1824–1837); *Description des animaux sans vertèbres découverts dans le bassin de Paris* (3 vols. and atlas, 1856–1866); *Catalogue des mollusques de l'île de la Réunion* (1863).

DESHOULIÈRES, ANTOINETTE DU LIGIER DE LA GARDE (1638–1694), French poet, was born in Paris on the 1st of January 1638. She was the daughter of Melchior du Ligier, sieur de la Garde, *maître d'hôtel* to the queens Marie de' Medici and Anne of Austria. She received a careful and very complete education, acquiring a knowledge of Latin, Spanish and Italian, and studying prosody under the direction of the poet Jean Hesnault. At the age of thirteen she married Guillaume de Boisguerin, seigneur Deshoulières, who followed the prince of Condé as lieutenant-colonel of one of his regiments to Flanders about a year after the marriage. Madame Deshoulières returned for a time to the house of her parents, where she gave herself to writing poetry and studying the philosophy of Gassendi. She rejoined her husband at Rocroi, near Brussels, where, being distinguished for her personal beauty, she became the object of embarrassing attentions on the part of the prince of Condé. Having made herself obnoxious to the government by her urgent demand for the arrears of her husband's pay, she was imprisoned in the château of Wilworden. After a few months she was freed by her husband, who attacked the château at the head of a small band of soldiers. An amnesty having been proclaimed, they returned to France, where Madame Deshoulières soon became a conspicuous personage at the court of Louis XIV. and in literary society. She won the friendship and admiration of the most eminent literary men of the age—some of her more zealous flatterers even going so far as to style her the tenth muse and the French Calliope. Her poems were very numerous, and included specimens of nearly all the minor forms, odes, eclogues, idylls, elegies, chansons, ballads, madrigals, &c. Of these the idylls alone, and only some of them, have stood the test of time, the others being entirely forgotten. She wrote several dramatic works, the best of which do not rise to mediocrity. Her friendship for Corneille made her take sides for the *Phèdre* of Pradon against that of Racine. Voltaire pronounced her the best of women French poets; and her reputation with her contemporaries is indicated by her election as a member of the Academy of the Ricovrati of Padua and of the Academy of Arles. In 1688 a pension of 2000 livres was bestowed upon her by the king, and she was thus relieved from the poverty in which she had long lived. She died in Paris on the 17th February 1694. Complete editions of her works were published at Paris in 1695, 1747, &c. These include a few poems by her daughter, Antoine Thérèse Deshoulières (1656–1718), who inherited her talent.

DESICCATION (from the Lat. *desiccare*, to dry up), the operation of drying or removing water from a substance. It is of particular importance in practical chemistry. If a substance admits of being heated to say 100°, the drying may be effected by means of an air-bath, which is simply an oven heated by gas or by steam. Otherwise a *desiccator* must be employed; this is essentially a closed vessel in which a hygroscopic substance is placed together with the substance to be dried. The process may be accelerated by exhausting the desiccator; this so-called vacuum desiccation is especially suitable for the concentration of aqueous solutions of readily decomposable substances. Of the hygroscopic substances in common use, phosphoric anhydride, concentrated sulphuric acid, and dry potassium hydrate are almost equal in power; sodium hydrate and calcium chloride are not much behind.

Two common types of desiccator are in use. In one the absorbent is placed at the bottom, and the substance to be dried above. Hempel pointed out that the efficiency would be increased by inverting this arrangement, since water vapour is lighter than air and consequently rises. Liquids are dried either by means of the desiccator, or, as is more usual, by shaking with a substance which removes the water. Fused calcium chloride is the commonest absorbent; but it must not be used with alcohols and several other compounds, since it forms compounds with these substances. Quicklime, barium oxide, and dehydrated copper sulphate are especially applicable to alcohol and ether; the last traces of water may be removed by adding metallic sodium and distilling. Gases are dried by leading them through towers or tubes containing an appropriate drying material. The experiments of H. B. Baker on the influence of moisture on chemical combination have shown the difficulty of removing the last traces of water.

In chemical technology, apparatus on the principle of the laboratory air-bath are mainly used. Crystals and precipitates, deprived of as much water as possible by centrifugal machines or filter-presses, are transported by means of a belt, screw, or other form of conveyer, on to trays staged in brick chambers heated directly by flue gases or steam pipes; the latter are easily controlled, and if the steam be superheated a temperature of 300° and over may be maintained. In some cases the material traverses the chamber from the coolest to the hottest part on a conveyer or in wagons. Rotating cylinders are also used; the material to be dried being placed inside, and the cylinder heated by a steam jacket or otherwise.

DESIDERIO DA SETTIGNANO (1428–1464), Italian sculptor, was born at Settignano, a village on the southern slope of the hill

of Fiesole, still surrounded by the quarries of sandstone of which the hill is formed, and inhabited by a race of "stone-cutters." Desiderio was for a short time a pupil of Donatello, whom, according to Vasari, he assisted in the work on the pedestal of David, and he seems to have worked also with Mino da Fiesole, with the delicate and refined style of whose works those of Desiderio seem to have a closer affinity than with the perhaps more masculine tone of Donatello. Vasari particularly extols the sculptor's treatment of the figures of women and children. It does not appear that Desiderio ever worked elsewhere than at Florence; and it is there that those who are interested in the Italian sculpture of the Renaissance must seek his few surviving decorative and monumental works, though a number of his delicately carved marble busts of women and children are to be found in the museums and private collections of Germany and France. The most prominent of his works are the tomb of the secretary of state, Marsuppini, in Santa Croce, and the great marble tabernacle of the Annunciation in San Lorenzo, both of which belong to the latter period of Desiderio's activity; and the cherubs' heads which form the exterior frieze of the Pazzi Chapel. Vasari mentions a marble bust by Desiderio of Marietta degli Strozzi, which for many years was held to be identical with a very beautiful bust bought in 1878 from the Strozzi family for the Berlin Museum. This bust is now, however, generally acknowledged to be the work of Francesco Laurana; whilst Desiderio's bust of Marietta has been recognized in another marble portrait acquired by the Berlin Museum in 1842. The Berlin Museum also owns a coloured plaster bust of an Urbino lady by Desiderio, the model for which is in the possession of the earl of Wemyss. Other important busts by the master are in the Bargello, Florence, the Louvre in Paris, the collections of M. Figdor and M. Benda in Vienna, and of M. Dreyfus in Paris. Like most of Donatello's pupils, Desiderio worked chiefly in marble, and not a single work in bronze has been traced to his hand.

See Wilhelm Bode, *Die italienische Plastik* (Berlin, 1893).

DESIDERIUS, the last king of the Lombards, is chiefly known through his connexion with Charlemagne. He was duke of Tuscany and became king of the Lombards after the death of Aistulf in 756. Seeking, like his predecessors, to extend the Lombard power in Italy, he came into collision with the papacy, and about 772 the new pope, Adrian I., implored the aid of Charlemagne against him. Other causes of quarrel already existed between the Frankish and the Lombard kings. In 770 Charlemagne had married a daughter of Desiderius; but he soon put this lady away, and sent her back to her father. Moreover, Gerberga, the widow of Charlemagne's brother Carloman, had sought the protection of the Lombard king after her husband's death in 771; and in return for the slight cast upon his daughter, Desiderius had recognized Gerberga's sons as the lawful Frankish kings, and had attacked Adrian for refusing to crown them. Such was the position when Charlemagne led his troops across the Alps in 773, took the Lombard capital, Ticinum, the modern Pavia, in June 774, and added the kingdom of Lombardy to his own dominions. Desiderius was carried to France, where he died, and his son, Adalgis, spent his life in futile attempts to recover his father's kingdom. The name of Desiderius appears in the romances of the Carolingian period.

See S. Abel, *Untergang des Langobardenreichs* (Göttingen, 1859); and *Jahrbücher des fränkischen Reiches unter Karl dem Grossen* (Leipzig, 1865); L. M. Hartmann, *Geschichte Italiens im Mittelalter* (Gotha, 1903); and Paulus Diaconus, *Historia Langobardorum*, edited by L. Bethmann and G. Waitz (Hanover, 1878).

DESIGN (Fr. *dessin*, drawing; Lat. *designare*, to mark out), in the arts, a drawing, more especially when made as a guide for the execution of work; that side of drawing which deals with arrangement rather than representation; and generally, by analogy, a deliberate planning, scheming or purpose. Modern use has tended to associate design with the word "original" in the sense of new or abnormal. The end of design, however, is properly utility, fitness and delight. If a discovery, it should be a discovery of what seems inevitable, an inspiration arising out of the conditions, and parallel to invention in the sciences. The faculty of design has best flourished when an almost spontaneous development was taking place in the arts, and while certain classes of arts, more or less noble, were generally demanded and the demand copiously satisfied, as in the production of Greek vases, Byzantine mosaics, Gothic cathedrals, and Renaissance paintings. Thus where a "school of design" arises there is much general likeness in the products but also a general progress. The common experience—"tradition"—is a part of each artist's stock in trade; and all are carried along in a stream of continuous exploration. Some of the arts, writing, for instance, have been little touched by conscious originality in design, all has been progress, or, at least, change, in response to conditions. Under such a system, in a time of progress, the proper limitations react as intensity; when limitations are removed the designer has less and less upon which to react, and unconditioned liberty gives him nothing at all to lean on. Design is response to needs, conditions and aspirations. The Greeks so well understood this that they appear to have consciously restrained themselves to the development of selected types, not only in architecture and literature, but in domestic arts, like pottery. Design with them was less the new than the true.

For the production of a school of design it is necessary that there should be a considerable body of artists working together, and a large demand from a sympathetic public. A process of continuous development is thus brought into being which sustains the individual effort. It is necessary for the designer to know familiarly the processes, the materials and the skilful use of the tools involved in the productions of a given art, and properly only one who practises a craft can design for it. It is necessary to enter into the traditions of the art, that is, to know past achievements. It is necessary, further, to be in relation with nature, the great reservoir of ideas, for it is from it that fresh thought will flow into all forms of art. These conditions being granted, the best and most useful meaning we can give to the word design is exploration, experiment, consideration of possibilities. Putting too high a value on originality other than this is to restrict natural growth from vital roots, in which true originality consists. To take design in architecture as an example, we have rested too much on definite precedent (a different thing from living tradition) and, on the other hand, hoped too much from newness. Exploration of the possibilities in arches, vaults, domes and the like, as a chemist or a mathematician explores, is little accepted as a method in architecture at this time, although in antiquity it was by such means that the great master-works were produced: the Pantheon, Santa Sophia, Durham and Amiens cathedrals. The same is true of all forms of design. Of course the genius and inspiration of the individual artist is not here ignored, but assumed. What we are concerned with is a mode of thought which shall make it most fruitful. (W. R. L.)

DESIRE, in popular usage, a term for a wishing or longing for something which one has not got. For its technical use see PSYCHOLOGY. The word is derived through the French from Lat. *desiderare*, to long or wish for, to miss. The substantive *desiderium* has the special meaning of desire for something one has once possessed but lost, hence regret or grief. The usual explanation of the word is to connect it with *sidus*, star, as in *considerare*, to examine the stars with attention, hence, to look closely at. If this is so, the history of the transition in meaning is unknown. J. B. Greenough (*Harvard Studies in Classical Philology*, i. 96) has suggested that the word is a military slang term. According to this theory *desiderare* meant originally to miss a soldier from the ranks at roll-call, the root being that seen in *sedere*, to sit, *sedes*, seat, place, &c.

DESK (from Lat. *discus*, quoit, in med. sense of "table," cf. "dish" and Ger. *Tisch*, table, from same source), any kind of flat or sloping table for writing or reading. Its earliest shape was probably that with which we are familiar in pictures of the monastic *scriptorium*—rather high and narrow with a sloping slab. The primitive desk had little accommodation for writing materials, and no storage room for papers; drawers, cupboards and pigeon-holes were the evolution of periods when writing grew common, and when letters and other documents requiring preservation became numerous. It

was long the custom to secure papers in chests or cabinets, whereas the modern desk serves the double purpose of a writing-table and a storehouse for documents. The first development from the early stall-like desk consisted of the addition of a drawer; then the table came to be supported upon legs or columns, which, as in the many beautiful examples constructed by Boulle and his school, were often of elaborate grace. Eventually the legs were replaced by a series of superimposed drawers forming pedestals —hence the familiar pedestal writing-table.

For a long period there were two distinct contemporary forms of desk—the table and the bureau or escritoire. The latter shape attained a popularity so great that, especially in England and America, it was found even in houses in which there was little occasion for writing. The English-speaking people of the 18th century were amazingly fond of pieces of furniture which served a double or triple purpose. The bureau—the word is the French generic appellation for a desk—derives its name from the material with which it was originally covered (Fr. *bure*, woollen cloth). It consists of an upright carcass sloping inward at the top, and provided with long drawers below. The upper part is fitted with small drawers and pigeon-holes, and often with secret places, and the writing space is formed by a hinged slab supported on runners; when not in use this slab closes up the sloping top. During the 18th century innumerable thousands of these bureaux were made on both sides of the Atlantic—indeed, if we except tables and chairs, no piece of old furniture is more common. In the first part of that period they were usually of oak, but when mahogany was introduced into Europe it speedily ousted the heavier-looking wood. Its deep rich colour and the high polish of which it was capable added appreciably to its ornamental appearance. While the pigeon-holes and small drawers were used for papers, the long drawers were often employed for purposes other than literary. In time the bureau-secretaire became a bureau-bookcase, the glazed shelves, which were often a separate erection, resting upon the top of the bureau. The cabinetmakers of the second half of the 18th century, the period of the greatest *floraison* of this combination, competed with each other in devising elegant frets for the glass fronts. Solid and satisfying to the eye, if somewhat severe in form, the mahogany bureau was usually an exceedingly presentable piece of furniture. Occasionally it had a *bombé* front which mitigated its severity; this was especially the case in the Dutch varieties, which were in a measure free adaptations of the French Louis Quinze *commode*. These Dutch bureaux, and the English ones made in imitation of them, were usually elaborately inlaid with floral designs in coloured woods; but whereas the Batavian marquetry was often rough and crude, the English work was usually of considerable excellence. Side by side with this form of writing apparatus was one variety or another of the writing-table proper. In so far as it is possible to generalize upon such a detail it would appear that the bureau was the desk of the yeoman and what we now call the lower middle class, and that the slighter and more table-like forms were preferred by those higher in the social scale. This probably means no more than that while the one class preserved the old English affection for the solid and heavy furniture which would last for generations, those who were more free to follow the fashions and fancies of their time were, as the pecuniarily easy classes always have been, ready to abandon the old for the new.

Just about the time when the flat table with its drawers in a single row, or in nests serving as pedestals, was finally assuming its familiar modern shape, an invention was introduced which was destined eventually, so far as numbers and convenience go, to supersede all other forms of desk. This was the cylinder-top writing-table. Nothing is known of the originator of this device, but it is certain that if not French himself he worked in France. The historians of French furniture agree in fixing its introduction about the year 1750, and we know that a desk worked on this principle was in the possession of the French crown in the year 1760. Even in its early days the cylinder took more than one form. It sometimes consisted of a solid piece of curved wood, and sometimes of a tambour frame—that is to say, of a series of narrow jointed strips of wood mounted on canvas; the revolving shutters of a shop-front are an adaptation of the idea. For a long period, however, the cylinder was most often solid, and remained so until the latter part of the 19th century, when the "American roll-top desk" began to be made in large numbers. This is indeed the old French form with a tambour cylinder, and it is now the desk that is most frequently met with all over the world for commercial purposes. Its popularity is due to its large accommodation, and to the facility with which the closing of the cylinder conceals all papers, and automatically locks every drawer. To France we owe not only the invention of this ubiquitous form but the construction of many of the finest and most historic desks that have survived—the characteristic marquetry writing-tables of the Boulle period, and the gilded splendours of that of Louis Quinze have never been surpassed in the history of furniture. Indeed, the "bureau du roi" which was made for Louis XV. is the most famous and magnificent piece of furniture that, so far as we know, was ever constructed. This desk, which is now one of the treasures of the Louvre, was the work of several artist-artificers chief among whom were Oeben and Riesener—Oeben, it may be added here as a matter of artistic interest, became the grandfather of Eugene Delacroix. The bureau is signed "Riesener fa 1769 à l'Arsenal de Paris," but it has been established that however great may have been the share of its construction which fell to him, the conception was that of Oeben. The work was ordered in 1760; it would thus appear that nine years were consumed in perfecting it, which is not surprising when we learn from the detailed account of its construction that the work began with making a perfect miniature model followed by one of full size. The "bureau du roi" is a large cylinder desk elaborately inlaid in marquetry of woods, and decorated with a wonderful and ornate series of mounts consisting of mouldings, plaques, vases and statuettes of gilt bronze cast and chased. These bronzes are the work of Duplessis, Winant and Hervieux. The desk, which shows plainly the transition between the Louis Quinze and Louis Seize styles, is as remarkable for the boldness of its conception as for the magnificent finish of its details. Its lines are large, flowing and harmonious, and although it is no longer exactly as it left the hands of its makers (Oeben died before it was finished) the alterations that have been made have hardly interfered with the general effect. For the head of the king for whom it was made that of Minerva in a helmet was substitued under his successor. The ciphers of Louis XV. have been removed and replaced by Sèvres plaques, and even the key which bore the king's initial crowned with laurels and palm leaves, with his portrait on the one side, and the fleur de lys on the other, has been interfered with by an austere republicanism. Yet no tampering with details can spoil the monumental nobility of this great conception. (J. P.-B.)

DESLONGCHAMPS, JACQUES AMAND EUDES- (1794–1867), French naturalist and palaeontologist, was born at Caen in Normandy on the 17th of January 1794. His parents, though poor, contrived to give him a good education, and he studied medicine in his native town to such good effect that in 1812 he was appointed assistant-surgeon in the navy, and in 1815 surgeon assistant major to the military hospital of Caen. Soon afterwards he proceeded to Paris to qualify for the degree of doctor of surgery, and there the researches and teachings of Cuvier attracted his attention to subjects of natural history and palaeontology. In 1822 he was elected surgeon to the board of relief at Caen, and while he never ceased to devote his energies to the duties of this post, he sought relaxation in geological studies. Soon he discovered remains of *Teleosaurus* in one of the Caen quarries, and he became an ardent palaeontologist. He was one of the founders of the museum of natural history at Caen, and acted as honorary curator; he was likewise one of the founders of the *Société linnéenne de Normandie* (1823), to the transactions of which society he communicated papers on *Teleosaurus*, *Poekilopleuron* (*Megalosaurus*), on Jurassic mollusca and brachiopoda. In 1825 he became professor of zoology to the faculty of sciences, and in 1847, dean. He died on the 17th of January 1867.

His son EUGÈNE EUDES-DESLONGCHAMPS (1830–1889), French

palaeontologist, was born in 1830. He succeeded his father about the year 1856 as professor of zoology at the faculty of sciences at Caen, and in 1861 he became also professor of geology and dean. After the death of his father in 1867, he devoted himself to the completion of a memoir on the Teleosaurs: the joint labours being embodied in his *Prodrome des Téléosauriens du Calvados*. To the Société Linnéenne de Normandie he contributed memoirs on Jurassic brachiopods, on the geology of the department of La Manche (1856), of Calvados (1856–1863), on the *Terrain callovien* (1859), on *Nouvelle-Calédonie* (1864), and *Études sur les étages jurassiques inférieurs de la Normandie* (1864). His work *Le Jura-normand* was issued in 1877–1878 (incomplete). He died at Château Matthieu, Calvados, on the 21st of December 1889.

DESMAISEAUX, PIERRE (1673–1745), French writer, was born at Saillat, probably in 1673. His father, a minister of the reformed church, had to leave France on the revocation of the edict of Nantes, and took refuge in Geneva, where Pierre was educated. Bayle gave him an introduction to the 3rd Lord Shaftesbury, with whom, in 1699, he came to England, where he engaged in literary work. He remained in close touch with the religious refugees in England and Holland, and constantly in correspondence with the leading continental savants and writers, who were in the habit of employing him to conduct such business as they might have in England. In 1720 he was elected a fellow of the Royal Society. Among his works are *Vie de St Évremond* (1711), *Vie de Boileau-Despréaux* (1712), *Vie de Bayle* (1730). He also took an active part in preparing the *Bibliothèque raisonnée des ouvrages de l'Europe* (1728–1753), and the *Bibliothèque britannique* (1733–1747), and edited a selection of St Evremond's writings (1706). Part of Desmaiseaux's correspondence is preserved in the British Museum, and other letters are in the royal library at Copenhagen. He died on the 11th of July 1745.

DESMAREST, NICOLAS (1725–1815), French geologist, was born at Soulaines, in the department of Aube, on the 16th of September 1725. Of humble parentage, he was educated at the college of the Oratorians of Troyes and Paris. Taking full advantage of the instruction he received, he was able to support himself by teaching, and to continue his studies independently. Buffon's *Theory of the Earth* interested him, and in 1753 he successfully competed for a prize by writing an essay on the ancient connexion between England and France. This attracted much attention, and ultimately led to his being employed in studying and reporting on manufactures in different countries, and in 1788 to his appointment as inspector-general of the manufactures of France. He utilized his journeys, travelling on foot, so as to add to his knowledge of the earth's structure. In 1763 he made observations in Auvergne, recognizing that the prismatic basalts were old lava streams, comparing them with the columns of the Giant's Causeway in Ireland, and referring them to the operations of extinct volcanoes. It was not, however, until 1774 that he published an essay on the subject, accompanied by a geological map, having meanwhile on several occasions revisited the district. He then pointed out the succession of volcanic outbursts and the changes the rocks had undergone through weathering and erosion. As remarked by Sir A. Geikie, the doctrine of the origin of valleys by the erosive action of the streams which flow through them was first clearly taught by Desmarest. An enlarged and improved edition of his map of the volcanic region of Auvergne was published after his death, in 1823, by his son ANSELME GAËTAN DESMAREST (1784–1838), who was distinguished as a zoologist, and author of memoirs on recent and fossil crustacea. He died in Paris on the 20th of September 1815.

See *The Founders of Geology*, by Sir A. Geikie (1897), pp. 48-78.

(H. B. Wo.)

DESMARETS (or DESMARETZ), **JEAN**, SIEUR DE SAINT-SORLIN (1595-1676), French dramatist and miscellaneous writer, was born in Paris in 1595. When he was about thirty he was introduced to Richelieu, and became one of the band of writers who carried out the cardinal's literary ideas. Desmarets's own inclination was to novel-writing, and the success of his romance *Ariane* in 1631 led to his formal admission to the circle that met at the house of Valentine Conrart and later developed into the Académie Française. Desmarets was its first chancellor. It was at Richelieu's request that he began to write for the theatre. In this kind he produced a comedy long regarded as a masterpiece, *Les Visionnaires* (1637); a prose tragedy, *Erigone* (1638); and *Scipion* (1639), a tragedy in verse. His success led to official preferment, and he was made *conseiller du roi, contrôleur-général de l'extraordinaire des guerres*, and secretary-general of the fleet of the Levant. His long epic *Clovis* (1657) is noteworthy because Desmarets rejected the traditional pagan background, and maintained that Christian imagery should supplant it. With this standpoint he contributed several works in defence of the moderns in the famous quarrel between the Ancients and Moderns. In his later years Desmarets devoted himself chiefly to producing a quantity of religious poems, of which the best-known is perhaps his verse translation of the *Office de la Vierge* (1645). He was a violent opponent of the Jansenists, against whom he wrote a *Réponse à l'insolente apologie de Port-Royal* . . . (1666). He died in Paris on the 28th of October 1676.

See also H. Rigault, *Histoire de la querelle des anciens et des modernes* (1856), pp. 80-103.

DESMARETS, NICOLAS, SIEUR DE MAILLEBOIS (1648–1721), French statesman, was born in Paris on the 10th of September 1648. His mother was the sister of J. B. Colbert, who took him into his offices as a clerk. He became counsellor to the parlement in 1672, master of requests in 1674 and intendant of finances in 1678. In these last functions he had to treat with the financiers for the coinage of new silver pieces of four sous. After Colbert's death he was involved in the legal proceedings taken against those financiers who had manufactured coins of bad alloy. The prosecution, conducted by the members of the family of Le Tellier, rivals of the Colberts, presented no proof against Desmarets. Nevertheless he was stripped of his offices and exiled to his estates by the king, on the 23rd of December 1683. In March 1686 he was authorized to return to Paris, and again entered into relations with the controllers-general of finance, to whom he furnished for more than ten years remarkable memoirs on the economic situation in France. As early as 1687 he showed the necessity for radical reforms in the system of taxation, insisting on the ruin of the people and the excessive expenses of the king. By these memoirs he established his claim to a place among the great economists of the time, Vauban, Boisguilbert and the comte de Boulainvilliers. When in September 1699 Chamillart was named controller-general of finances, he took Desmarets for counsellor; and when he created the two offices of directors of finances, he gave one to Desmarets (October 22, 1703). Henceforth Desmarets was veritable minister of finance. Louis XIV. had long conversations with him. Madame de Maintenon protected him. The economists Vauban and Boisguilbert exchanged long conversations with him. When Chamillart found his double functions too heavy, and retaining the ministry of war resigned that of finance in 1708, Desmarets succeeded him. The situation was exceedingly grave. The ordinary revenues of the year 1708 amounted to 81,977,007 livres, of which 57,833,233 livres had already been spent by anticipation, and the expenses to meet were 200,251,447 livres. In 1709 a famine reduced still more the returns from taxes. Yet Desmarets's reputation renewed the credit of the state, and financiers consented to advance money they had refused to the king. The emission of paper money, and a reform in the collection of taxes, enabled him to tide over the years 1709 and 1710. Then Desmarets decided upon an "extreme and violent remedy," to use his own expression,—an income tax. His "tenth" was based on Vauban's plan; but the privileged classes managed to avoid it, and it proved no better than other expedients. Nevertheless Louis XIV. managed to meet the most urgent expenses, and the deficit of 1715, about 350,000,000 livres, was much less than it would have been had it not been for Desmarets's reforms. The honourable peace which Louis was enabled to conclude at Utrecht with his enemies was certainly due to the resources which Desmarets procured for him.

After the death of Louis XIV. Desmarets was dismissed by the regent along with all the other ministers. He withdrew to

his estates. To justify his ministry he addressed to the regent a *Compte rendu*, which showed clearly the difficulties he had to meet. His enemies even like Saint Simon, had to recognize his honesty and his talents. He was certainly, after Colbert, the greatest finance minister of Louis XIV.

See Forbonnais, *Recherches et considérations sur les finances de la France* (2 vols., Basel, 1758); Montyon, *Particularités et observations sur les ministre des finances de la France* (Paris, 1812); De Boislisle, *Correspondance des contrôleurs-généraux des finances* (3 vols., Paris, 1873-1897); and the same author's "Desmarets et l'affaire des pièces de quatre sols" in the appendix to the seventh volume of his edition of the *Mémoires de Saint-Simon*. (E. Es.)

DES MOINES, the capital and the largest city of Iowa, U.S.A. and the county-seat of Polk county, in the south central part of the state, at the confluence of the Raccoon with the Des Moines river. Pop. (1890) 50,093; (1900) 62,139, of whom 7946 were foreign-born, including 1907 from Sweden and 1432 from Germany; (1910, census) 86,368. Des Moines is served by the Chicago, Burlington & Quincey, the Chicago & North-Western, the Chicago Great Western, the Chicago, Milwaukee & St Paul, the Chicago, Rock Island & Pacific, the Wabash, the Minneapolis & St Louis, and the Des Moines, Iowa Falls & Northern railways; also by several interurban electric lines. The chief building in Des Moines is the State Capitol, erected at a cost of about $3,000,000; other important buildings are the public library (containing, in 1908, 40,415 volumes), the court house, the post office, the Iowa State Historical building, a large auditorium and two hospitals. As a manufacturing centre the city has considerable importance. Among the leading products are those of the furnaces, foundries and machine shops, flour and grist mills, planing mills, creameries, bridge and iron works, publishing houses and a packing house; and brick, tile, pottery, patent medicines, furniture, caskets, tombstones, carriages, farm machinery, Portland cement, glue, gloves and hosiery. The value of the factory product in 1905 was $15,084,958, an increase of 79·7 % in five years. The city is in one of the most productive coal regions of the state, has a large jobbing trade, and is an important centre for the insurance business. The Iowa state fair is held here annually. In 1908 this city had a park system of 750 acres. Des Moines is the seat of Des Moines College, a Baptist institution, co-educational, founded in 1865 (enrolment, 1907–1908, 214); of Drake University (co-educational; founded in 1881 by the Disciples of Christ; now non-sectarian), with colleges of liberal arts, law, medicine, dental surgery and of the Bible, a conservatory of music, and a normal school, in which are departments of oratory and commercial training, and having in 1907–1908 1764 students, of whom 520 were in the summer school only; of the Highland Park College, founded in 1890; of Grand View College (Danish Lutheran), founded in 1895; and of the Capital City commercial college (founded 1884). A new city charter, embodying what has become known as the "Des Moines Plan" of municipal government, was adopted in 1907. It centralizes power in a council of five (mayor and four councilmen), nominated at a non-partisan primary and voted for on a non-partisan ticket by the electors of the entire city, ward divisions having been abolished. Elections are biennial. Other city officers are chosen by the council, and city employees are selected by a civil service commission of three members, appointed by the council. The mayor is superintendent of the department of public affairs, and each of the other administrative departments (accounts and finances, public safety, streets and public improvements, and parks and public property) is under the charge of one of the councilmen. After petition signed by a number of voters not less than 25 % of the number voting at the preceding municipal election, any member of the council may be removed by popular vote, to which all public franchises must be submitted, and by which the council may be compelled to pass any law or ordinance.

A fort called Fort Des Moines was established on the site of the city in 1843 to protect the rights of the Sacs and Foxes. In 1843 the site was opened to settlement by the whites; in 1851 Des Moines was incorporated as a town; in 1857 it was first chartered as a city, and, for the purpose of a more central location, the seat of government was removed hither from Iowa City. A fort was re-established here by act of Congress in 1900 and named Fort Des Moines. It is occupied by a full regiment of cavalry. The name of the city was taken from that of the river, which in turn is supposed to represent a corruption by the French of the original Indian name, *Moingona*,—the French at first using the abbreviation "moin," and calling the river "*la rivière des moins*" and then, the name having become associated with the Trappist monks, changing it into "*la rivière des moines*."

DESMOND, GERALD FITZGERALD, 15TH EARL OF (d. 1583), Irish leader, was son of James, 14th earl, by his second wife More O'Carroll. His father had agreed in January 1541, as one of the terms of his submission to Henry VIII., to send young Gerald to be educated in England. At the accession of Edward VI. proposals to this effect were renewed; Gerald was to be the companion of the young king. Unfortunately for the subsequent peace of Munster these projects were not carried out. The Desmond estates were held by a doubtful title, and claims on them were made by the Butlers, the hereditary enemies of the Geraldines, the 9th earl of Ormonde having married Lady Joan Fitzgerald, daughter and heiress-general of the 11th earl of Desmond. On Ormonde's death she proposed to marry Gerald Fitzgerald, and eventually did so, after the death of her second husband, Sir Francis Bryan. The effect of this marriage was a temporary cessation of open hostility between the Desmonds and her son, Thomas Butler, 10th earl of Ormonde.

Gerald succeeded to the earldom in 1558; he was knighted by the lord deputy Sussex, and did homage at Waterford. He soon established close relations with his namesake Gerald Fitzgerald, 11th earl of Kildare (1525–1585), and with Shane O'Neill. In spite of an award made by Sussex in August 1560 regulating the matters in dispute between Ormonde and the Fitzgeralds, the Geraldine outlaws were still plundering their neighbours. Desmond neglected a summons to appear at Elizabeth's court for some time on the plea that he was at war with his uncle Maurice. When he did appear in London in May 1562 his insolent conduct before the privy council resulted in a short imprisonment in the Tower. He was detained in England until 1564, and soon after his return his wife's death set him free from such restraint as was provided by her Butler connexion. He now raided Thomond, and in Waterford he sought to enforce his feudal rights on Sir Maurice Fitzgerald of Decies, who invoked the help of Ormonde. The two nobles thereupon resorted to open war, fighting a battle at Affane on the Blackwater, where Desmond was defeated and taken prisoner. Ormonde and Desmond were bound over in London to keep the peace, being allowed to return early in 1566 to Ireland, where a royal commission was appointed to settle the matters in dispute between them. Desmond and his brother Sir John of Desmond were sent over to England, where they surrendered their lands to the queen after a short experience of the Tower. In the meanwhile Desmond's cousin, James Fitzmaurice Fitzgerald, caused himself to be acclaimed captain of Desmond in defiance of Sidney, and in the evident expectation of usurping the earldom. He sought to give the movement an ultra-Catholic character, with the idea of gaining foreign assistance, and allied himself with John Burke, son of the earl of Clanricarde, with Connor O'Brien, earl of Thomond, and even secured Ormonde's brother, Sir Edmund Butler, whom Sidney had offended. Piers and Edward Butler also joined the rebellion, but the appearance of Sidney and Ormonde in the south-west was rapidly followed by the submission of the Butlers. Most of the Geraldines were subjugated by Humphrey Gilbert, but Fitzmaurice remained in arms, and in 1571 Sir John Perrot undertook to reduce him. Perrot hunted him down, and at last on the 23rd of February 1573 he made formal submission at Kilmallock, lying prostrate on the floor of the church by way of proving his sincerity.

Against the advice of the queen's Irish counsellors Desmond was allowed to return to Ireland in 1573, the earl promising not to exercise palatinate jurisdiction in Kerry until his rights to it were proved. He was detained for six months in Dublin, but in November slipped through the hands of the government, and

within a very short time had reduced to a state of anarchy the province which Perrot thought to have pacified by his severities. Edward Fitzgerald, brother of the earl of Kildare, and lieutenant of the queen's pensioners in London, was sent to remonstrate with Desmond, but accomplished nothing. Desmond asserted that none but Brehon law should be observed between Geraldines; and Fitzmaurice seized Captain George Bourchier, one of Elizabeth's officers in the west. Essex met the earl near Waterford in July, and Bourchier was surrendered, but Desmond refused the other demands made in the queen's name. A document offering £500 for his head, and £1000 to any one who would take him alive, was drawn up but was vetoed by two members of the council. On the 18th of July 1574 the Geraldine chiefs signed the "Combination" promising to support the earl unconditionally; shortly afterwards Ormonde and the lord deputy, Sir William Fitzwilliam, marched on Munster, and put Desmond's garrison at Derrinlaur Castle to the sword. Desmond submitted at Cork on the 2nd of September, handing over his states to trustees. Sir Henry Sidney visited Munster in 1575, but land affairs seemed to promise an early restoration of order. Fitzmaurice had fled to Brittany in company with other Geraldines, John Fitzgerald, seneschal of Imokilly, who held Ballymartyr against Sidney in 1567, and Edmund Ribbon, the son of the White Knight who had been attainted in 1571. He intrigued at the French and Spanish courts with Stucley, invasion of Ireland, and at Rome met the adventurer to make with whom he projected an expedition which in 1579 he landed a nephew of Gregory XIII. king of Ireland. Some Spanish in Smerwick Bay, where he was joined later by reinforced on the soldiers at the Fort del Ore. His ships were driven while on his 29th of July and he himself was slain in a skirmish by a kerne who had way to Tipperary. Nicholas Sanders, the pope's weakness, and accompanied Fitzmaurice, worked on Desmond had perhaps sought to draw him into open rebellion. Fitzmaurice; his indecisions been restrained before by jealousy of Sir William Pelham ceased when on the 1st of November Pelham and Kinsale by proclaimed him a traitor. The sack successes of Ormonde the Geraldines was speedily followed by General Winter. In June and Pelham acting in concert with Ormonde, but he maintained a 1581 Desmond had to take to the which, however, in June considerable following for some time, was reduced to four 1583, when Ormonde set a price on the head of November, he was persons. Five months later, only of soldiers. His brother seized and murdered by a servant and killed in December Sir John of Desmond had been had surrendered on the 14th 1581, and the seneschal of Imokilly the seneschal acted loyally, of June 1583. After his submission was arrested in 1587, and died but his lands excited envy. Eleanor Butler, the 15th earl left in Dublin Castle two days

By his second marriage James, 16th earl (1570–1601), spent two sons, the elder of whom after an unsuccessful attempt in most of his life in England he returned to England, 1600–1601 to recover the forfeiting extinct. where he died, the title

See G. E. C[okayne], *Complete Peerage*; R. Bagwell, *Ireland under the Tudors* (1885–1890); *Annals of Ireland by the Four Masters* (ed. J. O'Donovan) and the article FITZGERALD.

DESMOND (Irish *Deas Mhumha*), an ancient territorial division of Ireland, covering the eastern part of the modern Co. Kerry and the western part of Cork. Its creation as a kingdom is placed in the year 177 by Oliol Olum, king of Munster, divided his territory between two sons, giving Desmond to Eoghan, and Munster to Cormac. In 1329 Maurice Thomond Fitzgerald (d. 1356), lord of Decies and Desmond, Fitzthomas earl of Desmond by Edward III.; like other was created at that time he ruled his territory as a palatinate, earls acquired enormous powers and a large measure and authority. Meanwhile native kings continued to reign in of Desmond territory until 1596. In 1583 came the attainder of James Fitzgerald, 15th earl of Desmond (*q.v.*), and in 1586 an act declared the forfeiture of the Desmond estates to Queen. In 1571 a commission provided for the formation of Desmond into a county, and it was regarded as such for a few years, but by the beginning of the 17th century it was joined to Co. Kerry.

In 1619 the title of earl of Desmond was conferred on Richard Preston, Lord Dingwall, at whose death in 1628 it again became extinct. It was then bestowed on George Feilding, second son of William, earl of Denbigh, who had held the reversion of the earldom from 1622. His son William Feilding succeeded as earl of Denbigh in 1675, and thenceforward the title of Desmond was held in conjunction with that honour.

DESMOSCOLECIDA, a group of minute marine worm-like creatures. The body tapers towards each end and is marked by a number of well-defined ridges. These ridges resemble on a small scale those which surround the body of a *Porocephalus* (Linguatulida), and like them have no segmental significance. Their number varies in the different species. The head bears four setae, and some of the ridges bear a pair either dorsally or ventrally. The setae are movable. Two pigment spots between the fourth and fifth ridges are regarded as eyes. The Desmoscolecida move by looping their bodies like geometrid caterpillars or leeches, as well as by creeping on their setae. The mouth is terminal, and leads into a muscular oesophagus which opens into a straight intestine terminating in an anus, which is said to be dorsal in position. The sexes are distinct. The testis is single, and its duct opens into the intestine and is provided with two chitinous spicules. The ovary is also single, opening independently and anterior to the anus. The nervous system is as yet unknown.

From *Cambridge Natural History*, vol. ii., "Worms," &c., by permission of Macmillan & Co. Ltd.

Female *Desmoscolex elongatus* Panceri, ventral view, × 260. *a*, Ovary. (From Panceri.)

There are several species. *D. minutus* Clap. has been met with in the English Channel. Others are *D. nematoides* Greef, *D. adelphus* Greef, *D. chaetogaster* Greef, *D. elongatus* Panceri, *D. lanuginosa* Panceri. *Trichoderma oxycaudatum* Greef is 0·3 mm. long, and is also a "ringed creature with long hair-like bristles." The male has two spicules, and there is some doubt as to whether it should be placed with the Desmoscolecida or with the Nematoda. With regard to the systematic position of the group, it certainly comes nearest—especially in the structure of its reproductive organs—to the Nematoda. We still, however, are very ignorant of the internal anatomy of these forms, and until we know more it is impossible to arrive at a very definite conclusion as to their position in the animal kingdom.

See Panceri, *Atti Acc. Napoli.* vii. (1878); Greef, *Arch. Naturg.* 35 (i.) (1869), p. 112. (A. E. S.)

DESMOULINS, LUCIE SIMPLICE CAMILLE BENOIST (1760–1794), French journalist and politician, who played an important part in the French Revolution, was born at Guise, in Picardy, on the 2nd of March 1760. His father was lieutenant-general of the *bailliage* of Guise, and through the efforts of a friend obtained a *bourse* for his son, who at the age of fourteen left home for Paris, and entered the college of Louis le Grand. In this school, in which Robespierre was also a bursar and a distinguished student, Camille Desmoulins laid the solid foundation of his learning. Destined by his father for the law, at the completion of his legal studies he was admitted an advocate of the parlement of Paris in 1785. His professional success was not great; his manner was violent, his appearance unattractive, and his speech impaired by a painful stammer. He indulged, however, his love for literature, was closely observant of public affairs, and thus gradually

prepared himself for the main duties of his life—those of a political *littérateur*.

In March 1789 Desmoulins began his political career. Having been nominated deputy from the *bailliage* of Guise, he appeared at Laon as one of the commissioners for the election of deputies to the States-General summoned by royal edict of January 24th. Camille heralded its meeting by his *Ode to the States-General*. It is, moreover highly probable that he was the author of a radical pamphlet entitled *La Philosophie au peuple français*, published in 1788, the text of which is not known. His hopes of professional success were now scattered, and he was living in Paris in extreme poverty. He, however, shared to the full the excitement which attended the meeting of the States-General. As appears from his letters to his father, he watched with exultation the procession of deputies at Versailles, and with violent indignation the events of the latter part of June which followed the closing of the Salle des Menus to the deputies who had named themselves the National Assembly. It is further evident that Desmoulins was already sympathizing, not only with the enthusiasm, but also with the fury and cruelty, of the Parisian crowds.

The sudden dismissal of Necker by Louis XVI. was the event which brought Desmoulins to fame. On the 12th of July 1789 Camille, leaping upon a table outside one of the cafés in the garden of the Palais Royal, announced to the crowd the dismissal of their favourite. Losing, in his violent excitement, his stammer, he inflamed the passions of the mob by his burning words and his call "To arms!" "This dismissal," he said, "is the tocsin of the St Bartholomew of the patriots." Drawing, at last, two pistols from under his coat, he declared that he would not fall alive into the hands of the police who were watching his movements. He descended amid the embraces of the crowd, and his cry "To arms!" resounded on all sides. This scene was the beginning of the actual events of the Revolution. Following Desmoulins the crowd surged through Paris, procuring arms by force; and on the 13th it was partly organized as the Parisian militia which was afterwards to be the National Guard. On the 14th the Bastille was taken.

Desmoulins may be said to have begun on the following day that public literary career which lasted till his death. In May and June 1789 he had written *La France libre*, which, to his chagrin, his publisher refused to print. The taking of the Bastille, however, and the events by which it was preceded, were a sign that the times had changed; and on the 18th of July Desmoulins's work was issued. Considerably in advance of public opinion, it already pronounced in favour of a republic. By its erudite, brilliant and courageous examination of the rights of king, of nobles, of clergy and of people, it attained a wide and sudden popularity; it secured for the author the friendship and protection of Mirabeau, and the studied abuse of numerous royalist pamphleteers. Shortly afterwards, with his vanity and love of popularity inflamed, he pandered to the passions of the lower orders by the publication of his *Discours de la lanterne aux Parisiens*, which, with an almost fiendish reference to the excesses of the mob, he headed by a quotation from St John, *Qui male agit odit lucem*. Camille was dubbed "Procureur-général de la lanterne."

In November 1789 Desmoulins began his career as a journalist by the issue of the first number of a weekly publication, *Les Révolutions de France et de Brabant*. The title of the publication changed after the 73rd number. It ceased to appear at the end of July 1791.[1]

Success attended the *Révolutions* from its first to its last number, Camille was everywhere famous, and his poverty was relieved. These numbers are valuable as an exhibition not so much of events as of the feelings of the Parisian people; they are adorned, moreover, by the erudition, the wit and the genius of the author, but they are disfigured, not only by the most biting personalities and the defence and even advocacy of the excesses of the mob, but by the entire absence of the forgiveness and pity for which the writer was afterwards so eloquently to plead.

[1] In April 1792 Desmoulins founded with Stanislas Fréron a new journal, *La Tribune des patriotes*, but only four numbers appeared.

Desmoulins was powerfully swayed by the influence of more vigorous minds; and for some time before the death of Mirabeau, in April 1791, he had begun to be led by Danton, with whom he remained associated during the rest of his life. In July 1791 Camille appeared before the municipality of Paris as head of a deputation of petitioners for the deposition of the king. In that month, however, such a request was dangerous; there was excitement in the city over the presentation of the petition, and the private attacks to which Desmoulins had often been subject were now followed by a warrant for the arrest of himself and Danton. Danton left Paris for a little; Desmoulins, however, remained there, appearing occasionally at the Jacobin club. Upon the failure of this attempt of his opponents, Desmoulins published a pamphlet, *Jean Pierre Brissot démasqué*, which abounded in the most violent personalities. This pamphlet, which had its origin in a petty squabble, was followed in 1793 by a *Fragment de l'histoire secrète de la Révolution*, in which the party of the Gironde, and specially Brissot, were most mercilessly attacked. Desmoulins took an active part on the 10th of August and became secretary to Danton, when the latter became minister of justice. On the 8th of September he was elected one of the deputies for Paris to the National Convention, where, however, he was not successful as an orator. He was of the party of the "Mountain," and voted for the abolition of royalty and the death of the king. With Robespierre he was now more than ever associated, and the *Histoire des Brissotins*, the fragment above alluded to, was inspired by the arch-revolutionist. The success of the *brochure*, so terrible as to send the leaders of the Gironde to the guillotine, alarmed Danton and the author. Yet the rôle of Desmoulins during the Convention was of but secondary importance.

In December 1793 was issued the first number of the *Vieux Cordelier*, which was at first directed against the Hébertists and approved of by Robespierre, but which soon formulated Danton's idea of a committee of clemency. Then Robespierre turned against Desmoulins and took advantage of the popular indignation roused against the Hébertists to send them to death. The time had come, however, when Saint Just and he were to turn their attention not only to *les enragés*, but to *les indulgents*—the powerful faction of the Dantonists. On the 7th of January 1794 Robespierre, who on a former occasion had defended Camille when in danger at the hands of the National Convention, in addressing the Jacobin club counselled not the expulsion of Desmoulins, but the burning of certain numbers of the *Vieux Cordelier*. Camille sharply replied that he would answer with Rousseau,—"burning is not answering," and a bitter quarrel thereupon ensued. By the end of March not only were Hébert and the leaders of the extreme party guillotined, but their opponents, Danton, Desmoulins and the best of the moderates, were arrested. On the 31st the warrant of arrest was signed and executed, and on the 3rd, 4th and 5th of April the trial took place before the Revolutionary Tribunal. It was a scene of terror not only to the accused but to judges and to jury. The retorts of the prisoners were notable. Camille on being asked his age, replied, "I am thirty-three, the age of the *sans-culotte* Jesus, a critical age for every patriot." This was false; he was thirty-four.[2] The accused were prevented from defending themselves; a decree of the Convention denied them the right of speech. Armed with this and the false report of a spy, who charged the wife of Desmoulins with conspiring for the escape of her husband and the ruin of the republic, Fouquier-Tinville by threats and entreaties obtained from the jury a sentence of death. It was passed in absence of the accused, and their execution was appointed for the same day.

Since his arrest the courage of Camille had miserably failed. He had exhibited in the numbers of the *Vieux Cordelier* almost a disregard of the death which he must have known hovered over him. He had with consummate ability exposed the terrors of

[2] This is borne out by the register of his birth and baptism, and by words in his last letter to his wife,—"I die at thirty-four." The dates (1762-1794) given in so many biographies of Desmoulins are certainly inaccurate.

the Revolution, and had adorned his pages with illustrations from Tacitus, the force of which the commonest reader could feel. In his last number, the seventh, which his publisher refused to print, he had dared to attack even Robespierre, but at his trial it was found that he was devoid of physical courage. He had to be torn from his seat ere he was removed to prison, and as he sat next to Danton in the tumbrel which conveyed them to the guillotine, the calmness of the great leader failed to impress him. In his violence, bound as he was, he tore his clothes into shreds, and his bare shoulders and breast were exposed to the gaze of the surging crowd. Of the fifteen guillotined together, including among them Marie Jean Hérault de Séchelles, François Joseph Westermann and Pierre Philippeaux, Desmoulins died third; Danton, the greatest, died last.

On the 29th of December 1790 Camille had married Lucile Duplessis, and among the witnesses of the ceremony are observed the names of Brissot, Pétion and Robespierre. The only child of the marriage, Horace Camille, was born on the 6th of June 1792. Two days afterwards Desmoulins brought it into notice by appearing with it before the municipality of Paris to demand "the formal statement of the civil estate of his son." The boy was afterwards pensioned by the French government, died in Haiti in 1825. Lucile, Desmoulins's accomplished and affectionate wife, was, a few days after her husband, arrested as a false charge, condemned to the guillotine. She astonished the lookers by the calmness with which she braved death (April 13, 1794).

See J. Claretie, *Œuvres de Camille Desmoulins*; *Lucile Desmoulins, étude biographique . . .* &c. (Paris, 1874), and *Camille Desmoulins, étude sur les Dantonistes* (Paris, 1875); (Eng. trans., London, 1876); F. A. Aulard, *Les Orateurs de la Convention* (Paris, 1905, 2nd ed.); G. Lenôtre, "Le Desmoulins" (*Le Temps*, March 25, 1899).

DESNOYERS, JULES PIERRE FRANÇOIS STANISLAS (1800–1887), French geologist and archaeologist, born at Nogent-le-Rotrou, in the department of Eure-et-Loir, the 8th of October 1800. Becoming interested in geology at an early age, he was one of the founders of the Société Géologique de France in 1830. In 1834 he was appointed librarian of the Museum of Natural History in Paris. His contributions to geological science comprise memoirs on the Jurassic, Cretaceous, and Tertiary Strata of the Paris Basin and of Northern France, and other papers relating to the question of his co-existence with extinct mammalia (*Mémoires du Cotentin* (1825), *Sur la Craie et sur les terrains tertiaires* (1829), *Sur les cavernes* (1845). He died in 1887. *Recherches géologiques et historiques*

DESOR, EDUARD (1811–1882), Swiss geologist, was born at Friedberg, near Frankfort-on-Main, on the 13th of February 1811. Associated in early years with Agassiz he studied glacial phenomena, and in company with J. Desor afterwards became professor of geology in the academy at Neuchâtel, continued the study of Jurassic Echinoderms, but gave special attention to the old lake-habitations of Switzerland. He also investigated observations on the physical features of the Sahara. He died at Nizza on the 23rd of February 1882. His chief publications were: *Synopsis des Échinides fossiles* (1858), *Aus Sahara* (1865), *Der Gebirgsbau der Alpen* (2 vols., 1868–1873, with P. de Loriol). *Pfahlbauten des Neuenburger Sees* (1866),

DE SOTO, a city of Jefferson county, Missouri, U.S.A., on the Joachim m. S.S.W. of St Louis. Pop. (1890) 3960; (1900) 4196. Of this number 332 were foreign-born and 364 were negroes. It is served by the St Louis, Iron Mountain & Southern railway, which has repair shops here. About 2½ m. from De Soto is a mineral spring. In De Soto are Mount St Clement's which is a Roman Catholic, 1900), a theological seminary of the Congregation of the Most Holy Redeemer under the charge of the Catholic Fathers, and a Young Men's Christian Association. De Soto is in a good agricultural and fruit-growing region, which produces Indian corn, apples, plums, pears and small fruit. Lead and zinc are mined in the vicinity and shipped from the city in considerable quantities; and among the city's manufactures are shoes, flour and agricultural implements. The municipality owns the water-works, the water supply of which is furnished by artesian wells. De Soto was laid out in 1855 and was incorporated in 1869.

DESPARD, EDWARD MARCUS (1751–1803), Irish conspirator, was born in Queen's Co., Ireland, in 1751. In 1766 he entered the British navy, was promoted lieutenant in 1772, and stationed at Jamaica, where he soon proved himself to have considerable engineering talent. He served in the West Indies with credit, being promoted captain after the San Juan expedition (1779), when made governor of the Mosquito Shore and the Bay of Honduras, and in 1782 commander of a successful expedition against the Spanish possessions on the Black river. In 1784 he took over the administration of Yucatan. Upon frivolous charges he was suspended by Lord Grenville, and recalled to England. From 1790 to 1792 these charges were held over him, and when dismissed no compensation was forthcoming. His complaints caused him to be arrested in 1798, and with a short interval he remained in gaol until 1800. By that time Despard was desperate, and engaged in a plot to seize the Tower of London and Bank of England and assassinate George III. The whole idea was patently preposterous, but Despard was arrested, tried before a special commission, found guilty of high treason, and, with six of his fellow-conspirators, sentenced in 1803 to be hanged, drawn and quartered. These were the last men to be so sentenced in England. Despard was executed on the 21st of February 1803.

His eldest brother, JOHN DESPARD (1745–1829), had a long and distinguished career in the British army; gazetted an ensign in 1760, he was promoted through the various intermediate grades and became general in 1814. His most active service was in the American War of Independence, during which he was twice made prisoner.

DESPENSER, HUGH LE (d. 1265), chief justiciar of England, first plays an important part in 1258, when he was prominent on the baronial side in the Mad Parliament of Oxford. In 1260 the barons chose him to succeed Hugh Bigod as justiciar, and in 1263 the king was further compelled to put the Tower of London in his hands. On the outbreak of civil war he joined the party of Simon de Montfort, earl of Leicester, and led the Londoners when they sacked the manor-house of Isleworth, belonging to Richard, earl of Cornwall, king of the Romans. Having fought at Lewes (1264) he was made governor of six castles after the battle, and was then appointed one of the four arbitrators to mediate between Simon de Montfort and Gilbert de Clare, earl of Gloucester. He was summoned to Simon de Montfort's parliament in 1264, and acted as justiciar throughout the earl's dictatorship. Despenser was killed at Evesham in August 1265.

See C. Bémont, *Simon de Montfort* (Paris, 1884); T. F. Tout in *Owens College Historical Essays*, pp. 76 ff. (Manchester, 1902).

DESPENSER, HUGH LE (1262–1326), English courtier, was a son of the English justiciar who died at Evesham. He fought for Edward I. in Wales, France and Scotland, and in 1295 was summoned to parliament as a baron. Ten years later he was sent by the king to Pope Clement V. to secure Edward's release from the oaths he had taken to observe the charters in 1297. Almost alone Hugh spoke out for Edward II.'s favourite, Piers Gaveston, in 1308; but after Gaveston's death in 1312 he himself became the king's chief adviser, holding power and influence until Edward's defeat at Bannockburn in 1314. Then, hated by the barons, and especially by Earl Thomas of Lancaster, as a deserter from their party, he was driven from the council, but was quickly restored to favour and loaded with lands and honours, being made earl of Winchester in 1322. Before this time Hugh's son, the younger Hugh le Despenser, had become associated with his father, and having been appointed the king's chamberlain was enjoying a still larger share of the royal favour. About 1306 this baron had married Eleanor (d. 1337), one of the sisters and heiresses of Gilbert de Clare, earl of Gloucester, who was slain at

Bannockburn; and after a division of the immense Clare lands had been made in 1317 violent quarrels broke out between the Despensers and the husbands of the other heiresses, Roger of Amory and Hugh of Audley. Interwoven with this dispute was another between the younger Despenser and the Mowbrays, who were supported by Humphrey Bohun, earl of Hereford, about some lands in Glamorganshire. Fighting having begun in Wales and on the Welsh borders, the English barons showed themselves decidedly hostile to the Despensers, and in 1321 Edward II. was obliged to consent to their banishment. While the elder Hugh left England the younger one remained; soon the king persuaded the clergy to annul the sentence against them, and father and son were again at court. They fought against the rebellious barons at Boroughbridge, and after Lancaster's death in 132- they were practically responsible for the government of the country, which they attempted to rule in a moderate and constitutional fashion. But their next enemy, Queen Isabella, was more formidable, or more fortunate, than Lancaster. Returning to England after a sojourn in France in 1326 the queen directed her arms against her husband's favourites. The elder Despenser was seized at Bristol, where he was hanged on the 27th of October 1326, and the younger was taken with the king at Llantrisant and hanged at Hereford on the 24th of November following. The attainder against the Despensers was reversed in 1398. The intense hatred with which the barons regarded the Despensers was due to the enormous wealth which had passed into their hands, and to the arrogance and rapacity of the younger Hugh.

The younger Despenser left two sons, Hugh (1308–1349), and Edward, who was killed at Vannes in 1342.

The latter's son EDWARD LE DESPENSER (d. 1375) fought at the battle of Poitiers, and then in Italy for Pope Urban V.; he was a patron of Froissart, who calls him *le grand sire Despensier*. His son, THOMAS LE DESPENSER (1373–1400), the husband of Constance (d. 1416), daughter of Edmund of Langley, duke of York, supported Richard II. against Thomas of Woodstock, duke of Gloucester, and the other lords appellant in 1397, when he himself was created earl of Gloucester, but he deserted the king in 1399. Then, degraded from his earldom for participating in Gloucester's death, Despenser joined the conspiracy against Henry IV., but he was seized and was executed by a mob at Bristol in January 1400.

The elder Edward le Despenser left another son, HENRY (*c.* 1341–1406), who became bishop of Norwich in 1370. In early life Henry had been a soldier, and when the peasants revolted in 1381 he took readily to the field, defeated the insurgents at North Walsham, and suppressed the rising in Norfolk with some severity. More famous, however, was the militant bishop's enterprise on behalf of Pope Urban VI., who in 1382 employed him to lead a crusade in Flanders against the supporters of the anti-pope Clement VII. He was very successful in capturing towns until he came before Ypres, where he was checked, his humiliation being completed when his army was defeated by the French and decimated by a pestilence. Having returned to England the bishop was impeached in parliament and was deprived of his lands; Richard II., however, stood by him, and he soon regained an influential place in the royal council, and was employed to defend his country on the seas. Almost alone among his peers Henry remained true to Richard in 1399; he was then imprisoned, but was quickly released and reconciled with the new king, Henry IV. He died on the 23rd of August 1406. Despenser was an active enemy of the Lollards, whose leader, John Wycliffe, had fiercely denounced his crusade in Flanders.

The barony of Despenser, called out of abeyance in 1604, was held by the Fanes, earls of Westmorland, from 1626 to 1762; by the notorious Sir Francis Dashwood from 1763 to 1781; and by the Stapletons from 1788 to 1891. In 1891 it was inherited, through his mother, by the 7th Viscount Falmouth.

DES PÉRIERS, BONAVENTURE (*c.* 1500–1544), French author, was born of a noble family at Arnay-le-duc in Burgundy at the end of the 15th century. The circumstances of his education are uncertain, but he became a good classical scholar, and was attached to various noble houses in the capacity of tutor. In 1533 or 1534 Des Périers visited Lyons, then the most enlightened town of France, and a refuge for many liberal scholars who might elsewhere have had to suffer for their opinions. He gave some assistance to Robert Olivetan and Lefèvre d'Étaples in the preparation of the vernacular version of the Old Testament, and to Étienne Dolet in the *Commentarii linguae latinae*. In 1536 he put himself under the protection of Marguerite d'Angoulême, queen of Navarre, who made him her *valet-de-chambre*. He acted as the queen's secretary, and transcribed the *Heptaméron* for her. It is probable that his duties extended beyond those of a mere copyist, and some writers have gone so far as to say that the *Heptaméron* was his work. The free discussions permitted at Marguerite's court encouraged a licence of thought as displeasing to the Calvinists as to the Catholics. This free inquiry became scepticism in Bonaventure's *Cymbalum Mundi* . . . (1537), and the queen of Navarre thought it prudent to disavow the author, though she continued to help him privately until 1541. The book consisted of four dialogues in imitation of Lucian. Its allegorical form did not conceal its real meaning, and when it was printed by Morin, probably early in 1538, the Sorbonne secured the suppression of the edition before it was offered for sale. The dedication provides a key to the author's intention: *Thomas du Clevier (or Clenier) à son ami Pierre Tryocan* was recognized by 19th-century editors to be an anagram for *Thomas l'Incrédule à son ami Pierre Croyant*. The book was reprinted in Paris in the same year. It made many bitter enemies for the author. Henri Estienne called it *détestable*, and Étienne Pasquier said it deserved to be thrown into the fire with its author if he were still living. Des Périers prudently left Paris, and after some wanderings settled at Lyons, where he lived in poverty, until in 1544 he put an end to his existence by falling on his sword. In 1544 his collected works were printed at Lyons. The volume, *Recueil des œuvres de feu Bonaventure des Périers*, included his poems, which are of small merit, the *Traité des quatre vertus cardinales après Sénèque*, and a translation of the *Lysis* of Plato. In 1558 appeared at Lyons the collection of stories and fables entitled the *Nouvelles récréations et joyeux devis*. It is on this work that the claim put forward for Des Périers as one of the early masters of French prose rests. Some of the tales are attributed to the editors, Nicholas Denisot and Jacques Pelletier, but their share is certainly limited to the later ones. The book leaves something to be desired on the score of morality, but the stories never lack point and are models of simple, direct narration in the vigorous and picturesque French of the 16th century.

His *Œuvres françaises* were published by Louis Lacour (Paris, 2 vols., 1856). See also the preface to the *Cymbalum Mundi* . . . (ed. F. Franck, 1874); A. Chenevière, *Bonaventure Desperiers, sa vie, ses poésies* (1885); and P. Toldo, *Contributo allo studio della novella francese del XV. e XVI. secolo* (Rome, 1895).

DESPORTES, PHILIPPE (1546–1606), French poet, was born at Chartres in 1546. As secretary to the bishop of Le Puy he visited Italy, where he gained a knowledge of Italian poetry afterwards turned to good account. On his return to France he attached himself to the duke of Anjou, and followed him to Warsaw on his election as king of Poland. Nine months in Poland satisfied the civilized Desportes, but in 1574 his patron became king of France as Henry III. He showered favours on the poet, who received, in reward for the skill with which he wrote occasional poems at the royal request, the abbey of Tiron and four other valuable benefices. A good example of the light and dainty verse in which Desportes excelled is furnished by the well-known *villanelle* with the refrain "Qui premier s'en repentira," which was on the lips of Henry, duke of Guise, just before his tragic death. Desportes was above all an imitator. He imitated Petrarch, Ariosto, Sannazaro, and still more closely the minor Italian poets, and in 1604 a number of his plagiarisms were exposed in the *Rencontres des Muses de France et d'Italie*. As a sonneteer he showed much grace and sweetness, and English poets borrowed freely from him. In his old age Desportes acknowledged his ecclesiastical preferment by a translation of

the Psalms remembered chiefly for the brutal *mot* of Malherbe, "Votre potage vaut mieux que vos psaumes." Desportes died on the 5th of October 1606. He had published in 1573 an edition of his works including *Diane, Les Amours d'Hippolyte, Élégies, Bergeries, Œuvres chrétiennes*, &c.

An edition of his *Œuvres*, by Alfred Michiels, appeared in 1858.

DESPOT (Gr. δεσπότης, lord or master; the origin of the first part of the Gr. word is unknown, the second part is cognate with πόσις, husband, Lat. *potens*, powerful), in Greek usage the master of a household, hence the ruler of slaves. It was also used by the Greeks of their gods, as was the feminine form δέσποινα. It was, however, principally applied by the Greeks to the absolute monarchs of the eastern empires with which they came in contact; and it is in this sense that the word, like its equivalent "tyrant," is in current usage for an absolute sovereign whose rule is not restricted by any constitution. In the Roman empire of the East "despot" was early used as a title of honour or address of the emperor, and was given by Alexius I. (1081–1118) to the sons, brothers and sons-in-law of the emperor (Gibbon, *Decline and Fall*, ed. Bury, vol. vi. 80). It does not seem that the title was confined to the heir-apparent by Alexius II. (see Selden, *Titles of Honour*, part ii. chap. i. s. vi.). Later still it was adopted by the vassal princes of the empire. This gave rise to the name "despotats" as applied to these tributary states, which survived the break-up of the empire in the independent "despotats" of Epirus, Cyprus, Trebizond, &c. Under Ottoman rule the title was preserved by the despots of Servia and of the Morea, &c. The early use of the term as a title of address for ecclesiastical dignitaries survives in its use in the Greek Church as the formal mode of addressing a bishop.

DES PRÉS, JOSQUIN (*c.* 1445–1521), also called DEPRÉS or DESPREZ, and by a latinized form of his name, JODOCUS PRATENSIS or A PRATO, French musical composer, was born, probably in Condé in the Hennegau, about 1445. He was a pupil of Ockenheim, and himself one of the most learned musicians of his time. In spite of his great fame, the accounts of his life are vague and the dates contradictory. Fétis contributed greatly towards elucidating the doubtful points in his *Biographie universelle*. In his early youth Josquin seems to have been a member of the choir of the collegiate church at St Quentin; when his voice changed he went (about 1455) to Ockenheim to take lessons in counterpoint; afterwards he again lived at his birthplace for some years, till Pope Sixtus IV. invited him to Rome to teach his art to the musicians of Italy, where musical knowledge at that time was at a low ebb. In Rome Des Prés lived till the death of his protector (1484), and it was there that many of his works were written. His reputation grew rapidly, and he was considered by his contemporaries to be the greatest master of his age. Luther, who was a good judge, is credited with the saying that "other musicians do with notes what they can, Josquin what he likes." The composer's journey to Rome marks in a manner the transference of the art from its Gallo-Belgian birthplace to Italy, which for the next two centuries remained the centre of the musical world. To Des Prés and his pupils Arcadelt, Mouton and others, much that is characteristic in modern music owes its rise, particularly in their influence upon Italian developments under Palestrina. After leaving Rome Des Prés went for a time to Ferrara, where the duke Hercules I. offered him a home; but before long he accepted an invitation of King Louis XII. of France to become the chief singer of the royal chapel. According to another account, he was for a time at least in the service of the emperor Maximilian I. The date of his death has by some writers been placed as early as 1501. But this is sufficiently disproved by the fact of one of his finest compositions, *A Dirge (Déploration) for Five Voices*, being written to commemorate the death of his master Ockenheim, which took place after 1512. The real date of Josquin's decease has since been settled as the 27th of August 1521. He was at that time a canon of the cathedral of Condé (see Victor Delzant's *Sépultures de Flandre*, No. 118).

The most complete list of his compositions—consisting of masses, motets, psalms and other pieces of sacred music—will be found in Fétis. The largest collection of his MS. works, containing no less than twenty masses, is in the possession of the papal chapel in Rome. In his lifetime Des Prés was honoured as an eminent composer, and the musicians of the 16th century are loud in his praise. During the 17th and 18th centuries his value was ignored, nor does his work appear in the collections of Martini and Paolucci. Burney was the first to recover him from oblivion, and Forkel continued the task of rehabilitation. Ambros furnishes the most exhaustive account of his achievements. An admirable account of Josquin's art, from the rare point of view of a modern critic who knows how to allow for modern difficulties, will be found in the article "Josquin," in Grove's *Dictionary of Music and Musicians*, new ed. vol. ii. The *Répertoire des chanteurs de St Gervais* contains an excellent modern edition of Josquin's *Miserere*.

DESPRÈS, SUZANNE (1875–), French actress, was born at Verdun, and trained at the Paris Conservatoire, where in 1897 she obtained the first prize for comedy, and the second for tragedy. She then became associated with, and subsequently married, Aurelien Lugné-Poë (b. 1870), the actor-manager, who had founded a new school of modern drama, *L'Œuvre*, and she had a brilliant success in several plays produced by him. In succeeding years she played at the Gymnase and at the Porte Saint-Martin, and in 1902 made her début at the Comédie Française, appearing in *Phèdre* and other important parts.

DESRUES, ANTOINE FRANÇOIS (1744–1777), French poisoner, was born at Chartres in 1744, of humble parents. He went to Paris to seek his fortune, and started in business as a grocer. He was known as a man of great piety and devotion, and his business was reputed to be a flourishing one, but when, in 1773, he gave up his shop, his finances, owing to personal extravagance, were in a deplorable condition. Nevertheless he entered into negotiations with a Madame de la Mothe for the purchase from her of a country estate, and, when the time came for the payment of the purchase money, invited her to stay with him in Paris pending the transfer. While she was still his guest, he poisoned first her and then her son, a youth of sixteen. Then, having forged a receipt for the purchase money, he endeavoured to obtain possession of the property. But by this time the disappearance of Madame de la Mothe and her son had aroused suspicion. Desrues was arrested, the bodies of his victims were discovered, and the crime was brought home to him. He was tried, found guilty and condemned to be torn asunder alive and burned. The sentence was carried out (1777), Desrues repeating hypocritical protestations of his innocence to the last. The whole affair created a great sensation at the time, and as late as 1828 a dramatic version of it was performed in Paris.

DESSAIX, JOSEPH MARIE, COUNT (1764–1834), French general, was born at Thonon in Savoy on the 24th of September 1764. He studied medicine, took his degree at Turin, and then went to Paris, where in 1789 he joined the National Guard. In 1791 he tried without success to raise an *émeute* in Savoy, in 1792 he organized the "Legion of the Allobroges," and in the following years he served at the siege of Toulon, in the Army of the Eastern Pyrenees, and in the Army of Italy. He was captured at Rivoli, but was soon exchanged. In the spring of 1798 Dessaix was elected a member of the Council of Five Hundred. He was one of the few in that body who opposed the *coup d'état* of the 18th Brumaire (November 9, 1799). In 1803 he was promoted general of brigade, and soon afterwards commander of the Legion of Honour. He distinguished himself greatly at the battle of Wagram (1809), and was about this time promoted general of division and named grand officer of the Legion of Honour, and in 1810 was made a count. He took part in the expedition to Russia, and was twice wounded. For several months he was commandant of Berlin, and afterwards delivered the department of Mont Blanc from the Austrians. After the first restoration Dessaix held a command under the Bourbons. He nevertheless joined Napoleon in the Hundred Days, and in 1816 he was imprisoned for five months. The rest of his life was spent in retirement. He died on the 26th of October 1834.

See *Le Général Dessaix, sa vie politique et militaire*, by his nephew Joseph Dessaix (Paris, 1879).

DESSAU, a town of Germany, capital of the duchy of Anhalt, on the left bank of the Mulde, 2 m. from its confluence with the

Elbe, 67 m. S.W. from Berlin and at the junction of lines to Cöthen and Zerbst. Pop. (1905) 55,134. Apart from the old quarter lying on the Mulde, the town is well built, is surrounded by pleasant gardens and contains many handsome streets and spacious squares. Among the latter is the Grosse Markt with a statue of Prince Leopold I. of Anhalt-Dessau, "the old Dessauer." Of the six churches, the Schlosskirche, adorned with paintings by Lucas Cranach, in one of which ("The Last Supper") are portraits of several reformers, is the most interesting. The ducal palace, standing in extensive grounds, contains a colection of historical curiosities and a gallery of pictures, which indudes works by Cimabue, Lippi, Rubens, Titian and Van Dyck. Among other buildings are the town hall (built 1899–1900), the palace of the hereditary prince, the theatre, the administration offices, the law courts, the Amalienstift, with a picture gallery, several high-grade schools, a library of 30,000 volumes and an excellently appointed hospital. There are monuments to the philosopher Moses Mendelssohn (born here in 1729), to the poet Wilhelm Müller, father of Professor Max Müller, also a native of the place, to the emperor William I., and an obelisk commemorating the war of 1870-71. The industries of Dessau include the production of sugar, which is the chief manufacture, woollen, linen and cotton goods, carpets, hats, leather, tobacco and musical instruments. There is also a considerable trade in corn and garden produce. In the environs are the ducal villas of Georgium and Luisium, the gardens of which, as well as those of the neighbouring town of Wörlitz, are much admired.

Dessau was probably founded by Albert the Bear; it had attained civic rights as early as 1213. It first began to grow into importance at the close of the 17th century, in consequence of the religious emancipation of the Jews in 1686, and of the Lutherans in 1697.

See Wurdig, *Chronik der Stadt Dessau* (Dessau, 1876).

DESSEWFFY, AUREL, COUNT (1808–1842), Hungarian journalist and politician, eldest son of Count József Dessewffy and Eleonora Sztaray, was born at Nagy-Mihály, county Zemplén, Hungary. Carefully educated at his father's house, he was accustomed to the best society of his day. While still a child he could declaim most of the *Iliad* in Greek without a book, and read and quoted Tacitus with enthusiasm. Under the noble influence of Ferencz Kazinczy he became acquainted with the chief masterpieces of European literature in their original tongues. He was particularly fond of the English, and one of his early idols was Jeremy Bentham. He regularly accompanied his father to the diets of which he was a member, followed the course of the debates, of which he kept a journal, and made the acquaintance of the great Széchenyi, who encouraged his aspirations. On leaving college, he entered the royal aulic chancellery, and in 1832 was appointed secretary of the royal stadtholder at Buda. The same year he turned his attention to politics and was regarded as one of the most promising young orators of the day, especially during the sessions of the diet of 1832–1836, when he had the courage to oppose Kossuth. At the Pressburg diet in 1840 Dessewffy was already the leading orator of the more enlightened and progressive Conservatives, but incurred great unpopularity for not going far enough, with the result that he was twice defeated at the polls. But his reputation in court circles was increasing; he was appointed a member of the committee for the reform of the criminal law in 1840; and, the same year with a letter of recommendation from Metternich in his pocket, visited England and France, Holland and Belgium, made the acquaintance of Thiers and Heine in Paris, and returned home with an immense and precious store of practical information. He at once proceeded to put fresh life into the despondent and irresolute Conservative party, and the Magyar aristocracy, by gallantly combating in the *Világ* the opinions of Kossuth's paper, the *Pesti Hírlap*. But the multiplicity of his labours was too much for his feeble physique, and he died on the 9th of February 1842, at the very time when his talents seemed most indispensable.

See *Aus den Papieren des Grafen Aurel Dessewffy* (Pest, 1843); *Memorial Wreath to Count Aurel Dessewffy* (Hung.), (Budapest, 1857); *Collected Works of Count Dessewffy, with a Biography* (Hung.), (Budapest, 1887). (R. N. B.)

DESSOIR, LUDWIG (1810–1874), German actor, whose name was originally Leopold Dessauer, was born on the 15th of December 1810 at Posen, the son of a Jewish tradesman. He made his first appearance on the stage there in 1824 in a small part. After some experience at the theatre in Posen and on tour, he was engaged at Leipzig from 1834 to 1836. Then he was attached to the municipal theatre of Breslau, and in 1837 appeared at Prague, Brünn, Vienna and Budapest, where he accepted an engagement which lasted until 1839. He succeeded Karl Devrient at Karlsruhe, and went in 1847 to Berlin, where he acted Othello and Hamlet with such extraordinary success that he received a permanent engagement at the Hof-theater. From 1849 to 1872, when he retired on a pension, he played 110 parts, frequently on tour, and in 1853 acting in London. He died on the 30th of December 1874 in Berlin. Dessoir was twice married; his first wife, Theresa, a popular actress (1810–1866), was separated from him a year after marriage; his second wife went mad on the death of her child. By his first wife Dessoir had one son, the actor Ferdinand Dessoir (1836–1892). In spite of certain physical disabilities Ludwig Dessoir's genius raised him to the first rank of actors, especially as interpreter of Shakespeare's characters. G. H. Lewes placed Dessoir's Othello above that of Kean and the *Athenaeum* preferred him in this part to Brooks or Macready.

DESTOUCHES, PHILIPPE (1680–1754), French dramatist, whose real name was Néricault, was born at Tours in April 1680. When he was nineteen years of age he became secretary to M. de Puysieux, the French ambassador in Switzerland. In 1716 he was attached to the French embassy in London, where he remained for six years under the abbé Dubois. He contracted with a Lancashire lady, Dorothea Johnston, a marriage which was not avowed for some years. He drew a picture later of his own domestic circumstances in *Le Philosophe marié* (1726). On his return to France (1723) he was elected to the Academy, and in 1727 he acquired considerable estates, the possession of which conferred the privileges of nobility. He spent his later years at his château of Fortoiseau near Melun, dying on the 4th of July 1754. His early comedies were: *Le Curieux Impertinent* (1710), *L'Ingrat* (1712), *L'Irrésolu* (1713) and *Le Médisant* (1715). The best of these is *L'Irrésolu*, in which Dorante, after hesitating throughout the play between Julie and Célimène, marries Julie, but concludes the play with the reflection:—

"J'aurais mieux fait, je crois, d'épouser Célimène."

After eleven years of diplomatic service Destouches returned to the stage with the *Philosophe marié* (1727), followed in 1732 by his masterpiece *Le Glorieux*, a picture of the struggle then beginning between the old nobility and the wealthy *parvenus* who found their opportunity in the poverty of France. Destouches wished to revive the comedy of character as understood by Molière, but he thought it desirable that the moral should be directly expressed. This moralizing tendency spoilt his later comedies. Among them may be mentioned: *Le Tambour nocturne* (1736), *La Force du naturel* (1750) and *Le Dissipateur* (1736).

His works were issued in collected form in 1755, 1757, 1811 and, in a limited edition (6 vols.), 1822.

DESTRUCTORS. The name destructors is applied by English municipal engineers to furnaces, or combinations of furnaces, commonly called "garbage furnaces" in the United States, constructed for the purpose of disposing by burning of town refuse, which is a heterogeneous mass of material, including, besides general household and ash-bin refuse, small quantities of garden refuse, trade refuse, market refuse and often street sweepings. The mere disposal of this material is not, however, by any means the only consideration in dealing with it upon the destructor system. For many years past scientific experts, municipal engineers and public authorities have been directing careful attention to the utilization of refuse as fuel for steam production, and such progress in this direction has been made that in many towns its calorific value is now being utilized daily for motive-power purposes. On the other hand, that proper degree of caution which is obtained only by actual experience must be

exercised in the application of refuse fuel to steam-raising. When its value as a low-class fuel was first recognized, the idea was disseminated that the refuse of a given population was of itself sufficient to develop the necessary steam-power for supplying that population with the electric light. The economical importance of a combined destructor and electric undertaking of this character naturally presented a somewhat fascinating stimulus to public authorities, and possibly had much to do with the development both of the adoption of the principle of dealing with refuse by fire, and of lighting towns by electricity. However true this phase of the question may be as the statement of a theoretical scientific fact, experience so far does not show it to be a basis upon which engineers may venture to calculate, although, as will be seen later, under certain circumstances of equalized load, which must be considered upon their merits in each case, a well-designed destructor plant can be made to perform valuable commercial service to an electric or other power-using undertaking. Further, when a system, thermal or otherwise, for the storage of energy can be introduced and applied in a trustworthy and economical manner, the degree of advantage to be derived from the utilization of the waste heat from destructors will be materially enhanced.

Composition and quantity of refuse.

The composition of house refuse, which must obviously affect its calorific value, varies considerably in different localities, according to the condition, habits and pursuits of the people. Towns situated in coal-producing districts invariably yield a refuse richer in unconsumed carbon than those remote therefrom. It is also often found that the refuse from different parts of the same town varies considerably—that from the poorest quarters frequently proving of greater calorific value than that from those part occupied by the rich and middle classes. This has been attributed to the more extravagant habits of the working classes in neglecting to sift the ashes from their fires before disposing of them in the ash-bin. In Bermondsey, for example, the refuse has been found to possess an unusually high calorific value, and this experience is confirmed in other parts of the metropolis. Average refuse consists of breeze (cinder and ashes), coal and coke, fine dust, vegetable and animal matters, straw, shavings, cardboard, bottles, tins, iron, bones, broken crockery and other matters in very variable proportions according to the character of the district from which it is collected. In London the quantity of house refuse amounts approximately to 1¼ million tons per annum, which is equivalent to from 4 cwt. to 5 cwt. per head per annum, or to from 200 to 250 tons per 1000 of the population per annum. Statistics, however, vary widely in different districts. In the vicinity of the metropolis the amount varies from 2·5 cwt. per head per annum at Leyton to 3·5 cwt. at Hornsey, and to as much as 7 cwt. at Ealing. In the north of England the total house refuse collected, exclusive of street sweepings, amounts on the average to 8 cwt. per head per annum. Speaking generally, throughout the country an amount of from 5 cwt. to 10 cwt. per head per annum should be allowed for. A cubic yard of ordinary house refuse weighs from 12½ to 15 cwt. Shop refuse is lighter, frequently containing a large proportion of paper, straw and other light wastes. It sometimes weighs as little as 7½ cwt. per cubic yard. A load, by which refuse is often estimated, varies in weight from 15 cwt. to 1¼ tons.

Refuse disposal.

The question how a town's refuse shall be disposed of must be considered both from a commercial and a sanitary point of view. Various methods have been practised. Sometimes the household ashes, &c., are mixed with pail excreta, or with sludge from a sewage farm, or with lime, and disposed of for agricultural purposes, and sometimes they are conveyed in carts or by canal to outlying and country districts, where they are shot on waste ground or used to fill up hollows and raise the level of marshland. Such plans are economical when suitable outlets are available. To take the refuse out to sea in hopper barges and sink it in deep water is usually expensive and frequently unsatisfactory. At Bermondsey, for instance, the cost of barging is about 2s. 9d. a ton, while the material may be destroyed by fire at a cost of from 10d. to 1s. a ton, exclusive of interest and sinking fund on the cost of the works. In other cases, as at Chelsea and various dust contractors' yards, the refuse is sorted and its ingredients are sold; the fine dust may be utilized in connexion with manure manufactories, the pan and pans employed in forming the foundations of roads, and the cinders and vegetable refuse burnt to generate steam. In the Arnold system, carried [illegible] and other American towns, the refuse is sterilized by steam under [illegible], and fertilizing substances being extracted at the same time, while in other systems, such as those of Weil and Porno, and of Defose, distillation in closed vessels is practised. But the destructor system, in which the refuse is burned to an innocuous clinker in specially constructed furnaces, is that which must finally be resorted to, especially in districts which have become well built up and thickly populated.

Types of destructors.

Various types of furnaces and apparatus have from time to time been designed, and the subject has been one of much experiment and many failures. The principal towns in England which took the lead in the adoption of the refuse destructor system were Manchester, Birmingham, Leeds, Heckmondwike, Warrington, Blackburn, Bradford, Bury, Bolton, Hull, Nottingham, Salford, Ealing and London. Ordinary furnaces, built mostly by dust contractors, began to come into use in London and in the north of England in the second half of the 19th century, but they were not scientifically adapted to the purpose, and necessitated the admixture of coal or other fuel with the refuse to ensure its cremation. The Manchester corporation erected a furnace of this description about the year 1873, and Messrs Mead & Co. made an unsatisfactory attempt in 1870 to burn house refuse in closed furnaces at Paddington. In 1876 Alfred Fryer erected his destructor at Manchester, and several other towns adopted this furnace shortly afterwards. Other furnaces were from time to time brought before the public, among which may be mentioned those of Pearce and Lupton, Pickard, Healey, Thwaite, Young, Wilkinson, Burton, Hardie, Jacobs and Odgen. In addition to these the "Beehive" and the "Nelson" destructors became well known. The former was introduced by Stafford and Pearson

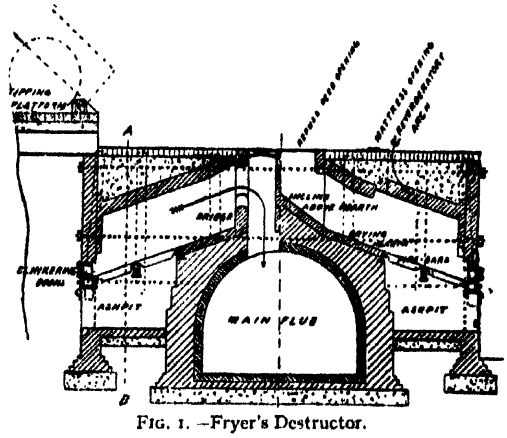

FIG. 1.—Fryer's Destructor.

of Burnley, and one was erected in 1884 in the parish yard at Richmond, Surrey, but the results being unsatisfactory, it was closed during the following year. The "Nelson" furnace, patented in 1885 by Messrs Richmond and Birtwistle, was erected at Nelson-in-Marsden, Lancashire, but being very costly in working was abandoned. The principal types of destructors now in use are those of Fryer, Whiley, Horsfall, Warner, Meldrum, Beaman and Deas, Heenan and Froude, and the "Sterling" destructor erected by Messrs Hughes and Stirling.

Fryer's.

The general arrangement of the destructor patented[1] by Alfred Fryer in 1876 is illustrated in fig. 1. An installation upon this principle consists of a number of furnaces or cells, usually arranged in pairs back to back, and enclosed in a rectangular block of brickwork having a flat top, upon which the house refuse is tipped from the carts.

[1] Patent No. 3125 (1876).

A large main flue, which also forms the dust chamber, is placed underneath the furnace hearths. The Fryer furnace ordinarily burns from 4 to 6 tons of refuse per cell per 24 hours. It will be observed that the outlets for the products of combustion are placed at the back near the refuse feed opening, an arrangement which is imperfect in design, inasmuch as while a charge of refuse is burning upon the furnace bars the charge which is to follow lies on the dead hearth near the outlet flue. Here it undergoes drying and partial decomposition, giving off offensive empyreumatic vapours which pass into the flue without being exposed to sufficient heat to render them entirely

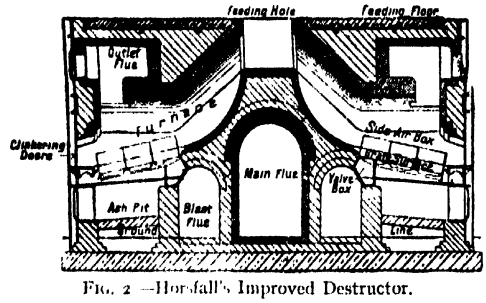

Fig. 2.—Horsfall's Improved Destructor.

inoffensive. The serious nuisances thus produced in some instances led to the introduction of a second furnace, or "cremator," patented by C. Jones of Ealing in 1885, which was placed in the main flue leading to the chimney-shaft, for the purpose of resolving the organic matters present in the vapour, but the greatly increased cost of burning due to this device led to its abandonment in many cases. This type of cell was largely used during the early period of the history of destructors, but has to a considerable extent given place to furnaces of more modern design.

A furnace[1] patented in 1891 by Mr Henry Whiley, superintendent of the scavenging department of the Manchester corporation, is automatic in its action and was designed primarily with a view to saving labour the cells being fed, stoked and clinkered automatically. There is no drying hearth, and the refuse carts tip direct into a shoot or hopper at the back which conducts the material directly on to movable eccentric grate bars. These automatically traverse the material forward into the furnace, and finally push it against a flap-door which opens and allows it to fall out. This apparatus is adapted for dealing with screened rather than unscreened refuse, since it suffers from the objection that the motion of the bars tends to allow fine particles to drop through unburnt. Some difficulty has been experienced from the refuse sticking in the

Whiley's.

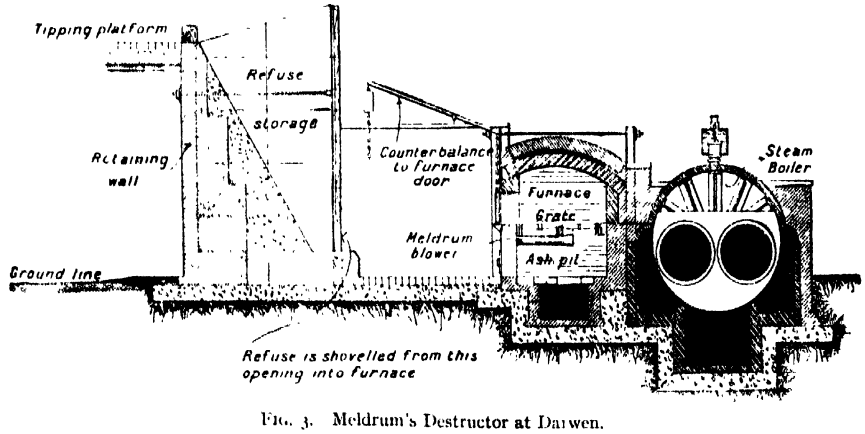

Fig. 3. Meldrum's Destructor at Darwen.

hopper, and exception may also be taken to the continual flapping of the door when the clinker passes out, as cold air is thereby admitted into the furnace. As in the Fryer cell, the outlet for the products of combustion into the main flue is close to the point where the crude refuse is fed into the furnace, and the escape of unburnt vapours is thus facilitated. Forced draught is applied by means of a Roots blower. The Manchester corporation has 28 cells of this type in use, and the approximate amount of refuse burnt per cell per 24 hours is from 6 to 8 tons at a cost per ton for labour of 3·47 pence.

Horsfall's destructor[2] (fig. 2) is a high-temperature furnace of modern type which has been adopted largely in Great Britain and on the continent of Europe. In it some of the general features of the Fryer cell are retained, but the details differ considerably from those of the furnaces already described. Important

Horsfall's.

points in the design are the arrangement of the flues and flue outlets for the products of combustion, and the introduction of a blast duct through which air is forced into a closed ash-pit. The feeding-hole is situated at the back of and above the furnace, while the flue opening for the emission of the gaseous products is placed at the front of the furnace over the dead plate; thus the gases distilled from the raw refuse are caused to pass on their way to the main flue over the hottest part of the furnace and through the flue opening in the red-hot reverberatory arch. The steam jet, which plays an important part in the Horsfall furnace, forces air into the closed ash-pit at a pressure of about ½ to 1 in. of water, and in this way a temperature varying from 1500° to 2000° F., as tested by a thermo-electric pyrometer, is maintained in the main flue. In a battery of cells the gases from each are delivered into one main flue, so that a uniform temperature is maintained therein sufficiently high to prevent noxious vapours from reaching the chimney. The cells being charged and clinkered in rotation, when the fire in one is green, in the others it is at its hottest, and the products of combustion do not reach the boiler surfaces until after they have been mixed in the main flue. The cast iron boxes which are provided at the sides of the furnaces, and through which the blast air is conveyed on its way to the grate, prevent the adhesion of clinker to the side walls of the cells, and very materially preserve the brickwork, which otherwise becomes damaged by the tools used to remove the clinker. The wide clinkering doors are suspended by counterbalance weights and open vertically. The rate of working of these cells varies from 8 tons per cell per 24 hours at Oldham to 10 tons per cell at Bradford, where the furnaces are of a later type. The cost of labour in stoking and clinkering is about 6d. per ton of the refuse treated at Bradford, and 9d. per ton at Oldham, where the rate of wages is higher. Well-constructed and properly-worked plants of this type should give rise to no nuisance, and may be located in populous neighbourhoods without danger to the public health or comfort. Installations were put down at Fulham (1901), Hammerton Street, Bradford (1900), West Hartlepool (1904), and other places, and the surplus power generated is employed in the production of electric energy.

Warner's destructor,[3] known as the "Perfectus," is, in general arrangement, similar to Fryer's, but differs in being provided with special charging hoppers, dampers in flues, dust-catching arrangements, rocking grate bars and other improvements. The refuse is tipped into feeding-hoppers, consisting of rectangular cast iron boxes over which plates are placed to prevent the escape of smoke and fumes. At the lower portion of the feeding-hopper is a flap-door working on an axis and controlled by an iron lever from the tipping platform. When refuse is to be fed into the furnace the lever is thrown over, the contents of the hopper drop on to the sloping firebrick hearth beneath, and the door is at once closed again. The door should be kept open as short a time as possible in order to prevent the admission of cold air into the furnace at the back end, since this leads to the lowering of the temperature of the cells and main flue, and also to paper and other light refuse being carried into the flues and chimney. The flues of each furnace are provided with dampers, which are closed during the process of clinkering in order to keep up the heat. The cells are each 5 ft. wide and 11 ft. deep, the rearmost portion consisting of a firebrick drying hearth, and the front of rocking grate bars upon which the combustion takes place. The crown of each cell is formed of a reverberatory firebrick arch having openings for the emission of the products of combustion. The flap dampers which are fitted to these openings are operated by horizontal spindles passing through the brickwork to the front of the cell, where they are provided with levers or handles; thus each cell can be worked independently of the others. With the view of increasing the steam-raising capabilities of the furnace, forced draught is sometimes applied and a tubular boiler is placed close to the cells. The amount of refuse consumed varies from 5 tons to 8 tons per cell per 24 hours. At Hornsey, where 12 cells of this type are in use, the cost of labour for burning the refuse is 9½d. per ton.

Warner's.

The Meldrum "Simplex" destructor (fig. 3), a type of furnace which yields good steam-raising results, is in successful operation at Rochdale, Hereford, Darwen, Nelson, Plumstead and Woolwich, at each of which towns the production of steam is an important consideration. Cells have also been laid down at Burton, Hunstanton, Blackburn and Shipley, and more recently at Burnley, Cleckheaton, Lancaster, Nelson, Sheerness and Weymouth. In general arrangement the destructor differs considerably from

Meldrum's.

[1] Patent No. 8271 (1891).
Patents No. 8909 (1887); No. 14,709 (1888); No. 22,531 (1891).

[2] Patent No. 18,719 (1888).

those previously described. The grates are placed side by side without separation except by dead plates, but, in order to localise the forced draught, the ash-pit is divided into parts corresponding with the different grate areas. Each ash-pit is closed air-tight by a cast iron plate, and is provided with an air-tight door for removing the fine ash. Two patent Meldrum steam-jet blowers are provided for each furnace, supplying any required pressure of blast up to 6 in. water column, though that usually employed does not exceed 1½ in. The furnaces are designed for hand-feeding from the front, but hopper-feeding can be applied if desirable. The products of combustion either pass away from the back of each fire-grate into a common flue leading to boilers and the chimney-shaft, or are conveyed sideways over the various grates and a common fire-bridge to the boilers or chimney. The heat in the gases, after passing the boilers, is still further utilized to heat the air supplied to the furnaces, the gases being passed through an air heater or continuous regenerator consisting of a number of cast iron pipes from which the air is delivered through the Meldrum "blowers" at a temperature of about 300° F. That a high percentage (15 to 18 %) of CO_2 is obtained in the furnaces proves a small excess of free oxygen, and no doubt explains the high fuel efficiency obtained by this type of destructor. High-pressure boilers of ample capacity are provided for the accumulation during periods of light load of a reserve of steam, the storage being obtained by utilizing the difference between the highest and lowest water-levels and the difference between the maximum and working steam-pressure. Patent locking fire-bars, to prevent lifting when clinkering, are used in the furnace and have a good life. At Rochdale the Meldrum furnaces consume from 53 lb to 66 lb of refuse per square foot of grate area per hour, as compared with 22·4 lb per cell square foot in a low-temperature destructor burning 6 tons per 24 hours with a grate area of 25 sq. ft. The evaporative efficiency of the Rochdale furnaces varies from 1·39 lb to 1·87 lb of water per lb of refuse (actual) per 1 lb of refuse burned, and an average steam-pressure of about 114 lb per square inch is maintained. The cost of labour and supervision amounts to 10d. per ton of refuse dealt with. A Lancashire boiler (22 ft. by 6 ft. 6 in.) at the Sewage Outfall Works, Hereford, evaporates with refuse fuel 2080 lb of water per hour, equal to 149 indicated horse-power. About 54 lb of refuse are burnt per square foot of grate area per hour with an evaporation of 1·82 lb of water per pound of refuse.

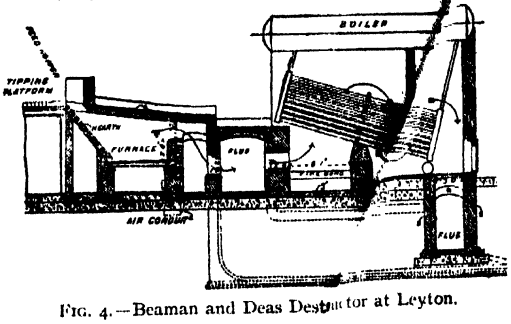

FIG. 4.—Beaman and Deas Destructor at Leyton.

The Beaman and Deas destructor[1] (fig. 4) has attracted much attention from public authorities, and successful installations are in operation at Warrington, Dewsbury, Leyton, Canterbury, Llandudno, Colne, Streatham, Rotherhithe, Wimbledon, Bolton and elsewhere. Its essential features include a level-fire grate with ordinary type bars, a high-temperature combustion chamber at the back of the cells, a closed ash-pit with forced draught, provision for the admission of a secondary air-supply at the fire-bridge, and a firebrick hearth sloping at an angle of about 52°. From the refuse storage platform the material is fed into a hopper mouth about 18 in. square, and slides down the firebrick hearth, supported by T-irons, to the grate bars, over which it is raked and spread with the assistance of long rods manipulated through clinkering doors placed at the sides of the cells. A secondary door in the rear of the cell facilitates the operation. The fire-bars, spaced only $\frac{1}{8}$ in. apart, are of the ordinary stationary type. Vertically, under the fire-bridge, is an air conduit, from the top of which lead air blast pipes 12 in. in diameter discharging into a hermetically closed ash-pit under the grate area. The air is supplied from fans (Schiele's patent) at a pressure of from 1½ to 2 in. of water, and is controlled by means of baffle valves worked by handles on either side of the furnace, conveniently placed for the attendant. The forced draught tends to keep the bars cool and lessen wear and tear. The fumes from the charge drying on the hearth pass through the fire and over the red-hot fire-bridge, which is perforated longitudinally with air-passages connected with a small flue leading from a grated opening on the face of the brickwork outside; in this way an auxiliary supply of heated oxygen is fed into the combustion chamber. This chamber, in which a temperature approaching 2000° F. is attained, is fitted with large iron doors, sliding with balance weights, which allow the introduction of infected articles, bad meat, &c., and also give access for the periodical removal of fine ash from the flues. The high temperatures attained are utilized by installing one boiler, preferably of the Babcock & Wilcox water-tube type, for each pair of cells, so that the gases, [illegible] three times before [illegible] to the main flue. [illegible] secondary furnace is provided under the boiler for [illegible] coal, if required, when the cells are out of use. The grate area of each cell is 25 sq. ft., and the consumption varies from 16 up to 20 tons of refuse per cell per 24 hours. In a 24-hours' test made by the superintendent of the cleansing department, Leeds, at the Warrington installation, the quantity of water evaporated per pound of refuse was 1·14 lb, the average temperature in the combustion chamber 2000° F. by copper-wire test, and the average air pressure with forced draught 2½ in. (water-gauge). At Leyton, which has a population of over 100,000, an 8-cell plant of this type is successfully dealing with house refuse and filter press cakes of sewage sludge from the sewage disposal works adjoining, and even with material of this low calorific value the total steam-power produced is considerable. Each cell burns about 16 tons of the mixture in 24 hours and develops about 35 indicated horse-power continuously, at an average steam-pressure in the boilers of 105 lb. The cost of labour at Leyton for burning the mixed refuse is about 1s. 7d. per ton; at Llandudno, where four cells were laid down in connexion with the electric-light station in 1898, it is 1s. 3½d., and at Warrington 9½d. per ton of refuse consumed. Combustion is complete, and the destructor may be installed in populous districts without nuisance to the inhabitants. Further patents (Wilkie's improvements) have been obtained by Meldrum Brothers (Manchester) in connexion with this destructor.

Heenan. The Heenan furnaces are in operation at Farnworth, Gloucester, Barrow-in-Furness, Northampton, Mansfield, Wakefield, Blackburn, Levenshulme, Kings Norton, Worthing, Birmingham and other places, and are now dealing with over 1200 tons of refuse per day. The general arrangement of this destructor somewhat resembles that of the Meldrum type. The cells intercommunicate, and the mechanical mixture of the gases arising from the furnace grates of the various cells is sought by the introduction of a special design of reverberatory arch overlying the grates. The standard arrangement of this destructor embodies all modern arrangements for high-temperature refuse destruction and steam-power generation.

Sterling. Destructors of the "Sterling" type, combined with electric-power generating stations, are installed at Hackney (1901), Bermondsey (1902) and Frederiksberg (1903)—the first-named plant being probably the most powerful combined destructor and electricity station yet erected. In these modern stations the recognized requirements of an up-to-date refuse-destruction plant have been well considered and good calorific results are also obtained.

In addition to the above-described destructors, other forms have been introduced from time to time, but adopted to a less degree; amongst these may be mentioned Baker's destructor, Willshear's, Hanson's Utilizer, Mason's Gasifier, the Bennett-Phythian, Cracknell's (Melbourne, Victoria), Coltman's (Loughborough), Willoughby's, and Healey's improved destructors. On the continent of Europe systems for the treatment of refuse have also been devised. Among these may be mentioned those of M. Defosse and M. Helouis. The former has endeavoured to burn the refuse in large quantities by using a forced draught and only washing the smoke.[2] Helouis has extended the operation by using the heat from the combustion of the refuse for drying and distilling the material which is brought gradually on to the grate.

Destructor accessories. Boulnois and Brodie's improved charging tank is a labour-saving apparatus consisting of a wrought iron truck, 5 ft. wide by 3 ft. deep, and of sufficient length to hold not less than 12 hours' supply for the two cells which it serves. The truck, which moves along a pair of rails laid across the top of the destructor, may be worked by one man. It is divided into compartments holding a charge of refuse in each, and is provided with a pair of doors in the bottom, opening downwards, which are supported by a series of small wheels running on a central rail. A special feeding opening in the reverberatory arch of the cell of the width of the truck, situated over the drying hearth, is formed by a firebrick arch fitted into a frame capable of being moved backwards and forwards by means of a lever. The charging truck, when empty, is brought under the tipping platform, and the carts tip directly into it. When one of the cells has to be fed, the truck is moved along, so that one of the divisions is immediately over the feeding opening, and the wheel holding up the bottom doors rests upon the central rail, which is continued over the movable covering arch. Then the movable arch is rolled back, the doors are released, and the contents are discharged into the cell, so that no handling of the refuse is required from tipping to feeding. This apparatus is in operation at Liverpool, Shoreditch, Cambridge and elsewhere.

Various forms of patent movable fire-bars have been employed

[1] Patents No. 15,598 (1893) and 23,712 (1893); also Beaman and Deas Sludge Furnace, Patent No. 13,029 (1894).

[2] *Compte Rendu des Travaux de la Société des Ingénieurs Civils de France*, folio 775 (June 1897).

in destructor furnaces. Among these may be mentioned Settle's,[1] Vicar's,[2] Riddle's rocking bars,[3] Horsfall's self-feeding apparatus,[4] and Healey's movable bars;[5] but complicated movable arrangements are not to be recommended and experience greatly favours the use of a simple stationary type of fire-bar.

A dust-catching apparatus has been designed and erected at Edinburgh, by the Horsfall Furnace Syndicate, in order to overcome difficulties in regard to the escape of flue dust, &c., from the destructor chimney. Externally, it appears a large circular block of brickwork, 18 ft. in diameter and 13 ft. 7 in. high, connected with the main flue, and situated between the destructor cells and the boiler. Internally it consists of a spiral flue traversing the entire circumference and winding upwards to the top of the chamber. There is an interior well or chamber 6 ft. diameter by 12 ft. high, having a domed top, and communicating with the outer spiral flue by four ports at the top of the chamber. Dust traps, baffle walls and cleaning doors are also provided for the retention and subsequent weekly removal of the flue dust. The apparatus forms a large reservoir of heat maintained at a steady temperature of from 1500° to 1800° F., and is useful in keeping up steam in the boiler at an equable pressure for a long period. It requires no attention, and has proved successful for its purpose.

Travelling cranes for transporting refuse and feeding cells are sometimes employed at destructor stations, as, for example, at Hamburg. Here the transportation of the refuse is effected by means of specially constructed water-tight iron wagons, containing detachable boxes provided with two double-flap doors at the top for loading, and one flap-door at the back for unloading. There are thirty-six furnaces of the Horsfall type placed in two ranks, each arranged in three blocks of six in the large furnace hall. An electric crane running above each rank lifts the boxes off the wagons and carries them to the feeding-hole of each well. Here the box is tipped up by an electric pulley and emptied on to the furnace platform. Where the travelling crane is used, the carts (four-wheeled) bringing the refuse may be constructed so that the body of the carriage can be taken off the wheels, lifted up and tipped direct over the furnace as required, and returned again to its frame. The adoption of the travelling crane admits of the reduction in size of the main building, as less platform space for unloading refuse carts is required; the inclined roadway may also be dispensed with. Where a destructor site will not admit of an inclined roadway and platform, the refuse may be discharged from the collecting carts into a lift, and thence elevated into the feeding-bins.

[1] Patent No. 15,482 (1885).
[2] Patents No. 1955 (1867) and No. 378 (1870).
[3] Patent No. 4896 (1891).
[4] Patent No. 20,207 (1892).
[5] Patents No. 18,308 (1892) and No. 12,990 (1892).

[6] Other accessory plant in use at most modern destructor stations includes machinery for the removal, crushing and various means of utilization of the residual clinker, stoking tools, air heaters or regenerators for the production of hot-air blast to the furnaces, superheaters and thermal storage arrangements for equalizing the output of power from the station during the 24-hours' day.

The general arrangement of a battery of refuse cells at a destructor station is illustrated by fig. 5. The cells are arranged either side by side, with a common main flue in the rear, or back to back with the main flue placed in the centre and leading to a tall chimney-shaft. The heated gases on leaving the cells pass through the combustion chamber into the main flue, and thence go forward to the boilers, where their heat is absorbed and utilized. Forced draught, or in many cases, hot blast, is supplied from fans through a conduit commanding the whole of the cells. An inclined roadway, of as easy gradient as circumstances will admit, is provided for the conveyance of the refuse to the tipping platform, from which it is fed through feed-holes into the furnaces. In the installation of a destructor, the choice of suitable plant and the general design of the works must be largely dependent upon local requirements, and should be entrusted to an engineer experienced in these matters. The following primary considerations, however, may be enumerated as materially affecting the design of such works:—

Working of destructors.

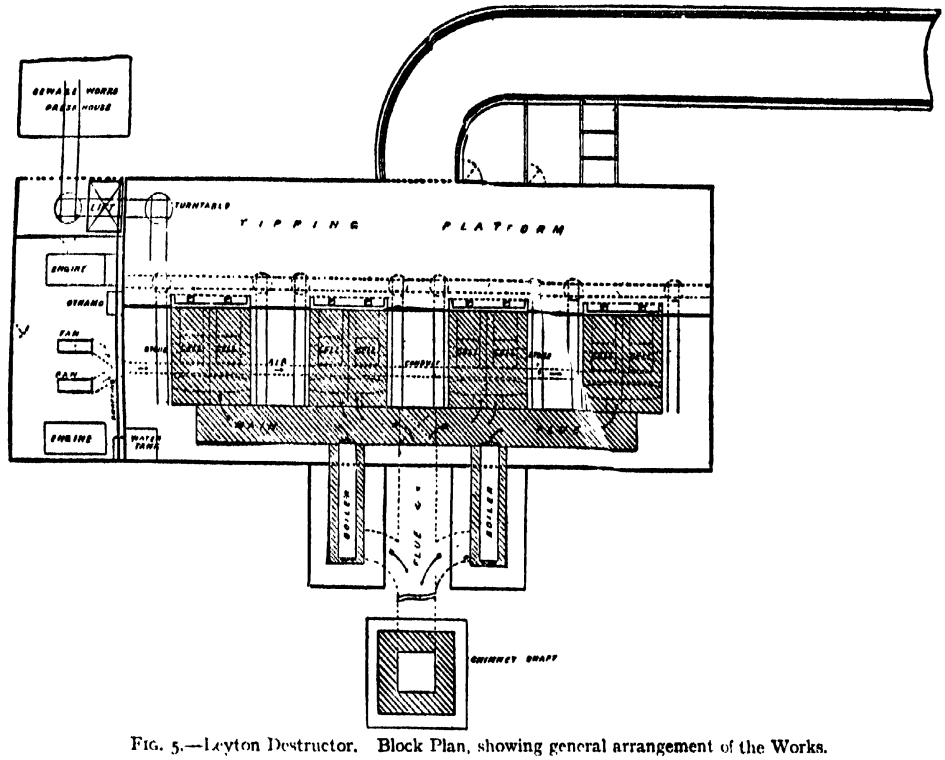

FIG. 5.—Leyton Destructor. Block Plan, showing general arrangement of the Works.

(*a*) The plant must be simple, easily worked without stoppages, and without mechanical complications upon which stokers may lay the blame for bad results. (*b*) It must be strong, must withstand variations of temperature, must not be liable to get out of order, and should admit of being readily repaired. (*c*) It must be such as can be easily understood by stokers or firemen of average intelligence, so that the continuous working of the plant may not be disorganized by change of workmen. (*d*) A sufficiently high temperature must be attained in the cells to reduce the refuse to an entirely innocuous clinker, and all fumes or gases should pass either through an adjoining red-hot cell or through a chamber whose temperature is maintained by the ordinary working of the destructor itself at a degree sufficient to exclude the possibility of the escape of any unconsumed gases, vapours or particles. The temperature may vary between 1500° and 2000°. (*e*) The plant must be so worked that while some of the cells are being recharged, others are at a glowing red heat, in order that a high temperature may be uniformly maintained. (*f*) The design of the furnaces must admit of clinkering and recharging being easily and quickly performed, the furnace doors being open for a minimum of time so as to obviate the inrush of cold air to lower the temperature

in main flues, &c. (*g*) The chimney draught must be assisted with forced draught from fans or steam jet to a pressure of 1½ in. to 2 in. under grates by water-gauge. (*h*) Where a destructor is required to work without risk of nuisance to the neighbouring inhabitants, its efficiency as a refuse destructor plant must be primarily kept in view in designing the works, steam-raising being regarded as a secondary consideration. Boilers should not be placed immediately over a furnace so as to present a large cooling surface, whereby the temperature of the gases is reduced before the organic matter has been thoroughly burned. (*i*) Where steam-power and a high fuel efficiency are desired a large percentage of CO_2 should be sought in the furnaces with as little excess of air as possible, and the flue gases should be utilized in heating the air-supply to the grates, and the feed-water to the boilers. (*j*) Ample boiler capacity and hot-water storage feed-tanks should be included in the design where steam-power is required.

As to the initial cost of the erection of refuse destructors, few trustworthy data can be given. The outlay necessarily depends, amongst other things, upon the difficulty of preparing the site, upon the nature of the foundations required, the height of the chimney-shaft, the length of the inclined or approach roadway, and the varying prices of labour and materials in different localities. As an example may be mentioned the case of Bristol, where, in 1892, the total cost of constructing a 16-cell Fryer destructor was £11,418, of which £2909 was expended on foundations and £1689 on the chimney-shaft; the cost of the destructor proper, buildings and approach road was therefore £6820, or about £426 per cell. The cost per ton of burning refuse in destructors depends mainly upon—(*a*) The price of labour in the locality, and the number of "shifts" or changes of workmen per day; (*b*) the type of furnace adopted; (*c*) the nature of the material to be consumed; (*d*) the interest on and repayment of capital outlay. The cost of working ton for ton consumed, in high-temperature furnaces, including labour and repairs, is not greater than in slow-combustion destructors. The average cost of burning refuse at twenty-four different towns throughout England, exclusive of interest on the cost of the works, is 1s. 1½d. per ton burned; the minimum cost is 6d. per ton at Bradford, and the maximum cost 2s. 10d. per ton at Battersea. At Shoreditch the cost per ton for the year ending on the 25th of March 1895, including labour, supervision, stores, repairs, &c. (but exclusive of interest on cost of works), was 2s. 6·9d. The quantity of refuse burned per cell per day of 24 hours varies from about 4 tons up to 20 tons. The ordinary low-temperature destructor, with 25 sq. ft. of grate area, burns about 20 lb of refuse per square foot of grate area per hour, or between 5 and 6 tons per cell per 24 hours. The Meldrum destructor furnaces at Rochdale burn as much as 66 lb per square foot of grate area per hour, and the Beaman and Deas destructor at Llandudno 71·7 lb per square foot per hour. The amount, however, always depends materially on the care observed in stoking, the nature of the material, the frequency of removal of clinker, and on the question whether the whole of the refuse passed into the furnace is thoroughly cremated.

Cost.

The amount of residue in the shape of clinker and fine ash varies from 22 to 37 % of the bulk dealt with. From 25 to 30 % is a very usual amount. At Shoreditch, where the refuse consists of about 8 % of straw, paper shavings, &c., the residue contains about 29 % clinker, 2·7 % fine ash, ·5 % flue dust, and ·6 % old tins, making a total residue of 32·8 %. As the residuum amounts to from one-fourth to one-third of the total bulk of the refuse dealt with, it is a question of the utmost importance that some profitable, or at least inexpensive, means should be devised for its regular disposal. Among other purposes, it has been used for bottoming for macadamized roads, for the manufacture of concrete, for making paving slabs, for forming suburban footpaths, under footwalks, and for the manufacture of mortar. The last is very general, and in many places profitable, mode of disposal. An entirely new outlet has also arisen for the disposal of good well-burned destructor clinker in connexion with the construction of bacteria beds for sewage disposal, and in many districts its value has by this means become greatly enhanced.

Residues.

Through defects in the design and management of many of the early destructors complaints of nuisance frequently arose, and these have, to some extent, brought destructor installations into disrepute. Although some of the older furnaces were decided offenders in this respect, that is by no means the case with the modern improved type of high-temperature furnace; and often, were it not for the great prominence in the landscape of a tall chimney-shaft, the existence of a refuse destructor in a neighbourhood would not be generally known to the inhabitants. A modern furnace, properly designed and worked, will give rise to no nuisance, and may be safely erected in the midst of a populous neighbourhood. To ensure the perfect cremation of the refuse and of the gases given off, forced draught is essential. This is supplied either as air draught delivered from a rapidly revolving fan, or as steam blast, as in the Horsfall steam jet or the Meldrum blower. With a forced blast less air is required to obtain complete combustion than by chimney draught. The forced draught grate requires little more than the quantity theoretically necessary, while with chimney draught more than double the theoretical amount of air must be supplied. With forced draught, too, a much higher temperature is attained, and if it is properly worked, little or no cold air will enter the furnaces during stoking operations. As far as possible a balance of pressure in the cells during clinkering should be maintained just sufficient to prevent an inrush of cold air through the flues. The forced draught pressure should not exceed 2 in. water-gauge. The efficiency of the combustion in the furnace is conveniently measured by the "Econometer," which registers continuously and automatically the proportion of CO_2 passing away in the waste gases; the higher the percentage of CO_2 the more efficient the furnace, provided there is no formation of CO, the presence of which would indicate incomplete combustion. The theoretical maximum of CO_2 is about 20 %, and, by maintaining an even clean fire, by admitting secondary air over the fire, and by regulating the dampers or the air-pressure in the ash-pit, an amount approximating to this percentage may be attained in a well-designed furnace if properly worked. If the proportion of free oxygen (*i.e.* excess of air) is large, more air is passed through the furnace than is required for complete combustion, and the heating of this excess is clearly a waste of heat. The position of the econometer in testing should be as near the furnace as possible, as there may be considerable air leakage through the brickwork of the flues.

Forced draught.

The air supply to modern furnaces is usually delivered hot, the air being first passed through an air-heater the temperature of which is maintained by the waste gases in the main flue.

The modern high-temperature destructor, to render the refuse and gases perfectly innocuous and harmless, is worked at a temperature varying from 1250° to 2000° F., and the maintenance of such temperatures has very naturally suggested the possibility of utilizing this heat-energy for the production of steam-power. Experience shows that a considerable amount of energy may be derived from steam-raising destructor stations, amply justifying a reasonable increase of expenditure on plant and labour. The actual calorific value of the refuse material necessarily varies, but, as a general average, with suitably designed and properly managed plant, an evaporation of 1 lb of water per pound of refuse burned is a result which may be readily attained, and affords a basis of calculation which engineers may safely adopt in practice. Many destructor steam-raising plants, however, give considerably higher results, evaporations approaching 2 lb of water per pound of refuse being often met with under favourable conditions.

Calorific value.

From actual experience it may be accepted, therefore, that the calorific value of unscreened house refuse varies from 1 to 2 lb of water evaporated per pound of refuse burned, the exact proportion depending upon the quality and condition of the material dealt with. Taking the evaporative power of coal at 10 lb of water per pound of coal, this gives for domestic house refuse a value of from $\frac{1}{10}$ to $\frac{1}{5}$ that of coal; or, with coal at 20s. per ton, refuse has a commercial value of from 2s. to 4s. per ton. In London the quantity of house refuse amounts to about 1¼ million tons per annum, which is equivalent to from 4 cwt. to 5 cwt. per head per annum. If it be burned in furnaces giving an evaporation of 1 lb of water per pound of refuse, it would yield a total power annually of about 138 million brake horse-power hours, and equivalent cost of coal at 20s. per ton for this amount of power even when calculated upon the very low estimate of 2 lb[1] of coal per brake horse-power hour, works out at over £123,000. On the same basis, the refuse of a medium-sized town, with, say, a population of 70,000 yielding refuse at the rate of 5 cwt. per head per annum, would afford 112 indicated horse-power per ton burned, and the total indicated horse-power hours per annum would be

$$\frac{70{,}000 \times 5 \text{ cwt.}}{20} \times 112 = 1{,}960{,}000 \text{ I.H.P. hours annually.}$$

If this were applied to the production of electric energy, the electrical horse-power hours would be (with a dynamo efficiency of 90 %)

$$\frac{1{,}960{,}000 \times 90}{100} = 1{,}764{,}000 \text{ E.H.P. hours per annum;}$$

and the watt-hours per annum at the central station would be

$$1{,}764{,}000 \times 746 = 1{,}315{,}944{,}000.$$

Allowing for a loss of 10 % in distribution, this would give 1,184,349,600 watt-hours available in lamps, or with 8-candle-power lamps taking 30 watts of current per lamp, we should have

$$\frac{1{,}184{,}349{,}600 \text{ watt-hours}}{30 \text{ watts}} = 39{,}478{,}320 \text{ 8-c.p. lamp-hours per annum;}$$

that is,

$$\frac{39{,}478{,}320}{70{,}000 \text{ population}} = 563 \text{ 8-c.p. lamp-hours per annum per head of population.}$$

Taking the loss due to the storage which would be necessary at 20 % on three-quarters of the total or 15 % upon the whole, there would be 478 8-c.p. lamp-hours per annum per head of the population; *i.e.* if the power developed from the refuse were fully utilized, it would supply electric light at the rate of one 8-c.p. lamp per head of the population for about 1½ hours for every night of the year.

In actual practice, when the electric energy is for the purposes of lighting only, difficulty has been experienced in fully utilizing the thermal energy from a destructor plant owing to the want of adequate means of storage either of the thermal or of the electric energy. A destructor station usually yields a fairly definite amount of thermal energy uniformly throughout the 24 hours, while the consumption of electric-lighting current is extremely

Difficulties.

[1] With medium-sized steam plants, a consumption of 4 lb of coal per brake horse-power per hour is a very usual performance.

irregular, the maximum demand being about four times the mean demand. The period during which the demand exceeds the mean is comparatively short, and does not exceed about 6 hours out of the 24, while for a portion of the time the demand may not exceed ¼th of the maximum. This difficulty, at first regarded as somewhat grave, is substantially minimized by the provision of ample boiler capacity, or by the introduction of feed thermal storage vessels in which hot feed-water may be stored during the hours of light load [illegible] at the time of maximum load the boiler may be filled directly from these vessels, which wor at the same pressure and temperature as the boiler. Further, he difficulty above mentioned will disappear entirely at stations where there is a fair day load which practically ceases at about the hour when the illuminating load comes on, thus equalizing the demand upon both destructor and electric plant throughout the 24 hours. This arises in cases where current is consumed during the day for motors, fans, lifts, electric tramways, and other like purposes, and, as the employment of electric energy for these services is rapidly becoming general, no difficulty need be anticipated in the successful working of combined destructor and electric plants where these conditions prevail. The more uniform the electrical demand becomes, the more fully may the power from a destructor station be utilized.

In addition to combination with electric-lighting works, refuse destructors are now very commonly installed in conjunction with various other classes of power using undertakings, including tramways, water-works, sewage pumping, artificial slab-making and clinker-crushing works and others; and the increasingly large sums which are being yearly expended in combined undertakings of this character is perhaps the strongest evidence of the practical value of such combinations where these several classes of work must be carried on.

For further information on the subject, reference should be made to William H. Maxwell, *Removal and Disposal of Town Refuse, with an exhaustive treatment of Refuse Destructor Plants* (London, 1899), with a special *Supplement* embodying later results (London, 1905).

See also the *Proceedings of the Incorporated Association of Municipal and County Engineers*, vols. xiii. p. 216, xxii. p. 211, xxiv. p. 214 and xxv. p. 148; also the *Proceedings of the Institution of Civil Engineers*, vols. cxxii. p. 443, cxxiv. p. 469, cxxxi. p. 413, cxxxviii. p. 508, cxxix. p. 434, cxxx. pp. 213 and 347, cxxiii. pp. 369 and 498, cxxviii. p. 293 and cxxxv. p. 300. (W. H. Ma.)

DE TABLEY, JOHN BYRNE LEICESTER WARREN, 3RD BARON (1835–1895), English poet, eldest son of George Fleming Leicester (afterwards Warren), 2nd Baron De Tabley, was born on the 26th of April 1835. He was educated at Eton and Christ Church, Oxford, where he took his degree in 1856 with second classes in classics and in law and modern history. In the autumn of 1858 he went to Turkey as unpaid attaché to Lord Stratford de Redcliffe, and two years later was called to the bar. He became an officer in the Cheshire Yeomanry, and unsuccessfully contested Mid-Cheshire in 1868 as a Liberal. After his father's second marriage in 1871 he removed to London, where he became a close friend of Tennyson for several years. From 1877 till his succession to the title in 1887 he was lost to his friends, assuming the life of a recluse. It was not till 1892 that he returned to London life, and enjoyed a sort of renaissance of reputation and friendship. During the later years of his life Lord De Tabley made many new friends, besides reopening old associations, and he almost seemed to be gathering around him a small literary company when his health broke, and he died on the 22nd of November 1895 at Ryde, in his sixty-first year. He was buried at Little Peover in Cheshire. Although his reputation will live almost exclusively as that of a poet, De Tabley was a man of many studious tastes. He was at one time an authority on numismatics; he wrote two novels; published *A Guide to the Study of Book Plates* (1880); and the fruit of his careful researches in botany was printed posthumously in his elaborate *Flora of Cheshire* (1899). Poetry, however, was his first and last passion, and to that he devoted the best energies of his life. De Tabley's first impulse towards poetry came from his friend George Fortescue, with whom he shared a close companionship during his Oxford days, and whom he lost, as Tennyson lost Hallam, within a few years of their taking their degrees. Fortescue was killed by falling from the mast of Lord Drogheda's yacht in November 1859, and this gloomy event plunged De Tabley into deep depression. Between 1859 and 1862 De Tabley issued four little volumes of pseudonymous verse (by G. F. Preston), in the production of which he had been greatly stimulated by the sympathy of Fortescue. Once more he assumed a pseudonym—his *Praeterita* (1863) bearing the name of William Lancaster. In the next year he published *Eclogues and Monodramas*, followed in 1865 by *Studies in Verse*. These volumes all displayed technical grace and much natural beauty; but it was not till the publication of *Philoctetes* in 1866 that De Tabley met with any wide recognition. *Philoctetes* bore the initials "M. A.," which, to the author's dismay, were interpreted as meaning Matthew Arnold. He at once disclosed his identity, and received the congratulations of his friends, among whom were Tennyson, Browning and Gladstone. In 1867 he published *Orestes*, in 1870 *Rehearsals* and in 1873 *Searching the Net*. These last two bore his own name, John Leicester Warren. He was somewhat disappointed by their lukewarm reception, and when in 1876 *The Soldier of Fortune*, a drama on which he had bestowed much careful labour, proved a complete failure, he retired altogether from the literary arena. It was not until 1893 that he was persuaded to return, and the immediate success in that year of his *Poems, Dramatic and Lyrical*, encouraged him to publish a second series in 1895, the year of his death. The genuine interest with which these volumes were welcomed did much to lighten the last years of a somewhat sombre and solitary life. His posthumous poems were collected in 1902. The characteristics of De Tabley's poetry are pre-eminently magnificence of style, derived from close study of Milton, sonority, dignity, weight and colour. His passion for detail was both a strength and a weakness: it lent a loving fidelity to his description of natural objects, but it sometimes involved him in a loss of simple effect from over-elaboration of treatment. He was always a student of the classic poets, and drew much of his inspiration directly from them. He was a true and a whole-hearted artist, who, as a brother-poet well said, "still climbed the clear cold altitudes of song." His ambition was always for the heights, a region naturally ice-bound at periods, but always a country of clear atmosphere and bright, vivid outlines.

See an excellent sketch by E. Gosse in his *Kit-cat Papers*. (A. Wa.)

DETAILLE, JEAN BAPTISTE EDOUARD (1848–), French painter, was born in Paris on the 5th of October 1848. After working as a pupil of Meissonier's, he first exhibited, in the Salon of 1867, a picture representing "A Corner of Meissonier's Studio." Military life was from the first a principal attraction to the young painter, and he gained his reputation by depicting the scenes of a soldier's life with every detail truthfully rendered. He exhibited "A Hab" (1868); "Soldiers at rest, during the Manœuvres at the Camp of Saint Maur" (1869); "Engagement between Cossacks and the Imperial Guard, 1814" (1870). The war of 1870–71 furnished him with a series of subjects which gained him repeated successes. Among his more important pictures may be named "The Conquerors" (1872); "The Retreat" (1873); "The Charge of the 9th Regiment of Cuirassiers in the Village of Morsbronn, 6th August 1870" (1874); "The Marching Regiment, Paris, December 1874" (1875); "A Reconnaissance" (1876); "Hail to the Wounded!" (1877); "Bonaparte in Egypt" (1878); the "Inauguration of the New Opera House"—a water-colour; the "Defence of Champigny by Faron's Division" (1879). He also worked with Alphonse de Neuville on the panorama of Rezonville. In 1884 he exhibited at the Salon the "Evening at Rezonville," a panoramic study, and "The Dream" (1888), now in the Luxemburg. Detaille recorded other events in the military history of his country: the "Sortie of the Garrison of Huningue" (now in the Luxemburg), the "Vincendon Brigade," and "Bizerte," reminiscences of the expedition to Tunis. After a visit to Russia, Detaille exhibited "The Cossacks of the Ataman" and "The Hereditary Grand Duke at the Head of the Hussars of the Guard." Other important works are: "Victims to Duty," "The Prince of Wales and the Duke of Connaught" and "Pasteur's Funeral." In his picture of "Châlons, 9th October 1896," exhibited in the Salon, 1898, Detaille painted the emperor and empress of Russia at a review, with M. Félix Faure. Detaille became a member of the French Institute in 1898.

See Marius Vachon, *Detaille* (Paris, 1898); Frédéric Masson, *Édouard Detaille and his work* (Paris and London, 1891); J. Claretie, *Peintres et sculpteurs contemporains* (Paris, 1876); G. Goetschy, *Les Jeunes peintres militaires* (Paris, 1878).

DETAINER (from *detain*, Lat. *detinere*), in law, the act of keeping a person against his will, or the wrongful keeping of a person's goods, or other real or personal property. A writ of detainer was a form for the beginning of a personal action against a person already lodged within the walls of a prison; it was superseded by the Judgments Act 1838.

DETERMINANT, in mathematics, a function which presents itself in the solution of a system of simple equations.

1. Considering the equations

$$\begin{aligned} ax + by + cz &= d, \\ a'x + b'y + c'z &= d', \\ a''x + b''y + c''z &= d'', \end{aligned}$$

and proceeding to solve them by the so-called method of cross multiplication, we multiply the equations by factors selected in such a manner that upon adding the results the whole coefficient of y becomes $= 0$, and the whole coefficient of z becomes $= 0$; the factors in question are $b'c'' - b''c'$, $b''c - bc''$, $bc' - b'c$ (values which, as at once seen, have the desired property); we thus obtain an equation which contains on the left-hand side only a multiple of x, and on the right-hand side a constant term; the coefficient of x has the value

$$a(b'c'' - b''c') + a'(b''c - bc'') + a''(bc' - b'c),$$

and this function, represented in the form

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix},$$

is said to be a determinant; or, the number of elements being 3^2, it is called a determinant of the third order. It is to be noticed that the resulting equation is

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix} x = \begin{vmatrix} d, & b, & c \\ d', & b', & c' \\ d'', & b'', & c'' \end{vmatrix},$$

where the expression on the right-hand side is the like function with d, d', d'' in place of a, a', a'' respectively, and is of course also a determinant. Moreover, the functions $b'c'' - b''c'$, $b''c - bc''$, $bc' - b'c$ used in the process are themselves the determinants of the second order

$$\begin{vmatrix} b', & c' \\ b'', & c'' \end{vmatrix}, \quad \begin{vmatrix} b'', & c'' \\ b, & c \end{vmatrix}, \quad \begin{vmatrix} b, & c \\ b', & c' \end{vmatrix}.$$

We have herein the suggestion of the rule for the derivation of the determinants of the orders 1, 2, 3, 4, &c., each from the preceding one, viz. we have

$$|a| = a,$$

$$\begin{vmatrix} a, & b \\ a', & b' \end{vmatrix} = a|b'| - a'|b|.$$

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix} = a\begin{vmatrix} b', & c' \\ b'', & c'' \end{vmatrix} + a'\begin{vmatrix} b'', & c'' \\ b, & c \end{vmatrix} + a''\begin{vmatrix} b, & c \\ b', & c' \end{vmatrix},$$

$$\begin{vmatrix} a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \\ a''', & b''', & c''', & d''' \end{vmatrix} = a\begin{vmatrix} b', & c', & d' \\ b'', & c'', & d'' \\ b''', & c''', & d''' \end{vmatrix} - a'\begin{vmatrix} b'', & c'', & d'' \\ b''', & c''', & d''' \\ b, & c, & d \end{vmatrix} + a''\begin{vmatrix} b''', & c''', & d''' \\ b, & c, & d \\ b', & c', & d' \end{vmatrix} - a'''\begin{vmatrix} b, & c, & d \\ b', & c', & d' \\ b'', & c'', & d'' \end{vmatrix},$$

and so on, the terms being all + for a determinant of an odd order, but alternately + and − for a determinant of an even order.

2. It is easy, by induction, to arrive at the general results:—

A determinant of the order n is the sum of the $1.2.3 \ldots n$ products which can be formed with n elements out of n^2 elements arranged in the form of a square, no two of the n elements being in the same line or in the same column, and each such product having the coefficient ± unity.

The products in question may be obtained by permuting in every possible manner the columns (or the lines) of the determinant, and then taking for the factors the n elements in the dexter diagonal. And we thence derive the rule for the signs, viz. considering the primitive arrangement of the columns as positive, then an arrangement obtained therefrom by a single interchange (inversion, or derangement) of two columns is regarded as negative; and so in general an arrangement is positive or negative according as it is derived from the primitive arrangement by an even or an odd number of interchanges. [This implies the theorem that a given arrangement can be derived from the primitive arrangement only by an odd number, or else only by an even number of interchanges,—a theorem the verification of which may be easily obtained from the theorem (in fact a particular case of the general one), an arrangement can be derived from itself only by an even number of interchanges.] And this being so, each product has the sign belonging to the corresponding arrangement of the columns; in particular, a determinant contains with the sign + the product of the elements in its dexter diagonal. It is to be observed that the rule gives [illegible] arrangements, the number of such being [illegible].

The rule of signs may be expressed in a different form. Giving to the columns in the primitive arrangement the numbers 1, 2, 3 . . , to obtain the sign belonging to any other arrangement we take as often as a lower number succeeds a higher one, the sign −, and, compounding together all these minus signs, obtain the proper sign, + or − as the case may be.

Thus, for three columns, it appears by either rule that 123, 231, 312 are positive; 213, 321, 132 are negative; and the developed expression of the foregoing determinant of the third order is

$$= ab'c'' - ab''c' + a'b''c - a'bc'' + a''bc' - a''b'c.$$

3. It further appears that a determinant is a linear function[1] of the elements of each column thereof, and also a linear function of the elements of each line thereof; moreover, that the determinant retains the same value, only its sign being altered, when any two columns are interchanged, or when any two lines are interchanged; more generally, when the columns are permuted in any manner, or when the lines are permuted in any manner, the determinant retains its original value, with the sign + or − according as the new arrangement (considered as derived from the primitive arrangement) is positive or negative according to the foregoing rule of signs. It at once follows that, if two columns are identical, or if two lines are identical, the value of the determinant is = 0. It may be added, that if the lines are converted into columns, and the columns into lines, in such a way as to leave the dexter diagonal unaltered, the value of the determinant is unaltered; the determinant is in this case said to be *transposed*.

4. By what precedes it appears that there exists a function of the n^2 elements, linear as regards the terms of each column (or say, for shortness, linear as to each column), and such that only the sign is altered when any two columns are interchanged; these properties completely determine the function, except as to a common factor which may multiply all the terms. If, to get rid of this arbitrary common factor, we assume that the product of the elements in the dexter diagonal has the coefficient + 1, we have a complete definition of the determinant, and it is interesting to show how from these properties, assumed for the definition of the determinant, it at once appears that the determinant is a function serving for the solution of a system of linear equations. Observe that the properties show at once that if any column is = 0 (that is, if the elements in the column are each = 0), then the determinant is = 0; and further, that if any two columns are identical, then the determinant is = 0.

5. Reverting to the system of linear equations written down at the beginning of this article, consider the determinant

$$\begin{vmatrix} ax + by + cz - d, & b, & c \\ a'x + b'y + c'z - d', & b', & c' \\ a''x + b''y + c''z - d'', & b'', & c'' \end{vmatrix};$$

it appears that this is

$$= x\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix} + y\begin{vmatrix} b, & b, & c \\ b', & b', & c' \\ b'', & b'', & c'' \end{vmatrix} + z\begin{vmatrix} c, & b, & c \\ c', & b', & c' \\ c'', & b'', & c'' \end{vmatrix} - \begin{vmatrix} d, & b, & c \\ d', & b', & c' \\ d'', & b'', & c'' \end{vmatrix};$$

viz. the second and third terms each vanishing, it is

$$= x\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix} - \begin{vmatrix} d, & b, & c \\ d', & b', & c' \\ d'', & b'', & c'' \end{vmatrix}.$$

But if the linear equations hold good, then the first column of the

[1] The expression, a linear function, is here used in its narrowest sense, a linear function without constant term; what is meant is that the determinant is in regard to the elements $a, a', a'', \ldots$ of any column or line thereof, a function of the form $Aa + A'a' + A''a'' + \ldots$, without any term independent of $a, a', a'' \ldots$

original determinant is = 0, and therefore the determinant itself is = 0; that is, the linear equations give

$$x\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix} - \begin{vmatrix} d, & b, & c \\ d', & b', & c' \\ d'', & b'', & c'' \end{vmatrix} = 0,$$

which is the result obtained above.

We might in a similar way find the values of y and z, but there is no occasion to do so. Join to the original equations the new equation

$$\alpha x + \beta y + \gamma z = \delta;$$

a like process shows that, the equations being satisfied we have

$$\begin{vmatrix} a, & \beta, & \gamma, & \delta \\ a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \end{vmatrix} = 0;$$

or, as this may be written,

$$\begin{vmatrix} a, & \beta, & \gamma \\ a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix} - \delta \begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix} = 0;$$

which, considering δ as standing herein for its value $\alpha x + \beta y + \gamma z$, is a consequence of the original equations only: we have thus an expression for $\alpha x + \beta y + \gamma z$, an arbitrary linear function of the unknown quantities x, y, z; and by comparing the coefficients of α, β, γ on the two sides respectively, we have the values of x, y, z; in fact, these quantities, each multiplied by

$$\begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix},$$

are in the first instance obtained in the forms

$$\begin{vmatrix} 1 & & & \\ a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \end{vmatrix}, \quad \begin{vmatrix} & 1 & & \\ a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \end{vmatrix}, \quad \begin{vmatrix} & & 1 & \\ a, & b, & c, & d \\ a', & b', & c', & d' \\ a'', & b'', & c'', & d'' \end{vmatrix};$$

but these are

$$= \begin{vmatrix} b, & c, & d \\ b', & c', & d' \\ b'', & c'', & d'' \end{vmatrix}, \quad - \begin{vmatrix} c, & d, & a \\ c', & d', & a' \\ c'', & d'', & a'' \end{vmatrix}, \quad \begin{vmatrix} d, & a, & b \\ d', & a', & b' \\ d'', & a'', & b'' \end{vmatrix},$$

or, what is the same thing,

$$= \begin{vmatrix} b, & c, & d \\ b', & c', & d' \\ b'', & c'', & d'' \end{vmatrix}, \quad \begin{vmatrix} c, & a, & d \\ c', & a', & d' \\ c'', & a'', & d'' \end{vmatrix}, \quad \begin{vmatrix} a, & b, & d \\ a', & b', & d' \\ a'', & b'', & d'' \end{vmatrix}$$

respectively.

6. *Multiplication of two Determinants of the same Order.*—The theorem is obtained very easily from the last preceding definition of a determinant. It is most simply expressed thus—

$$\begin{matrix} & (a, a', a''), (\beta, \beta', \beta''), (\gamma, \gamma', \gamma'') \\ (a, b, c) \\ (a', b', c') \\ (a'', b'', c'') \end{matrix} \begin{vmatrix} \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \end{vmatrix} \cdot \begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix} \cdot \begin{vmatrix} \alpha', & \beta, & \gamma \\ \alpha', & \beta', & \gamma' \\ \alpha', & \beta'', & \gamma'' \end{vmatrix},$$

where the expression on the left side stands for a determinant, the terms of the first line being $(a, b, c)(\alpha, \alpha', \alpha'')$, that is, $a\alpha + b\alpha' + c\alpha''$, $(a, b, c)(\beta, \beta', \beta'')$, that is, $a\beta + b\beta' + c\beta''$, $(a, b, c)(\gamma, \gamma', \gamma'')$, that is $a\gamma + b\gamma' + c\gamma''$; and similarly the terms in the second and third lines are the like functions with (a', b', c') and (a'', b'', c'') respectively.

There is an apparently arbitrary transposition of lines and columns; the result would hold good if on the left-hand side we had written $(\alpha, \beta, \gamma), (\alpha', \beta', \gamma'), (\alpha'', \beta'', \gamma'')$, or what is the same thing, if on the right-hand side we had transposed the second determinant; and either of these changes would, it might be thought, increase the elegance of the form, but, for a reason which need not be explained,[1] the form actually adopted is the preferable one.

To indicate the method of proof, observe that the determinant on the left-hand side, *qua* linear function of its columns, may be broken up into a sum of $(3^3 =)$ 27 determinants, each of which is either of some such form as

$$\pm\alpha\beta\gamma' \begin{vmatrix} a, & a, & b \\ a', & a', & b' \\ a'', & a'', & b'' \end{vmatrix},$$

where the term $\alpha\beta\gamma'$ is not a term of the $\alpha\beta\gamma$-determinant, and its coefficient (as a determinant with two identical columns) vanishes; or else it is of a form such as

$$\pm\alpha\beta'\gamma'' \begin{vmatrix} a, & b, & c \\ a', & b', & c' \\ a'', & b'', & c'' \end{vmatrix},$$

that is, every term which does not vanish contains as a factor the *abc*-determinant last written down; the sum of all other factors $\pm\alpha\beta'\gamma''$ is the $\alpha\beta\gamma$-determinant of the formula; and the final result then is, that the determinant on the left-hand side is equal to the product on the right-hand side of the formula.

7. *Decomposition of a Determinant into complementary Determinants.*—Consider, for simplicity, a determinant of the fifth order, $5 = 2 + 3$, and let the top two lines be

$$\begin{matrix} a, & b, & c, & d, & e \\ a', & b', & c', & d', & e' \end{matrix}$$

then, if we consider how these elements enter into the determinant, it is at once seen that they enter only through the determinants of the second order $\begin{vmatrix} a, & b \\ a', & b' \end{vmatrix}$, &c., which can be formed by selecting any two columns at pleasure. Moreover, representing the remaining three lines by

$$\begin{matrix} a'', & b'', & c'', & d'', & e'' \\ a''', & b''', & c''', & d''', & e''' \\ a'''', & b'''', & c'''', & d'''', & e'''' \end{matrix}$$

it is further seen that the factor which multiplies the determinant formed with any two columns of the first set is the determinant of the third order formed with the complementary three columns of the second set; and it thus appears that the determinant of the fifth order is a sum of all the products of the form

$$\pm \begin{vmatrix} a, & b \\ a', & b'' \end{vmatrix} \cdot \begin{vmatrix} c'', & d'', & e'' \\ c''', & d''', & e''' \\ c'''', & d'''', & e'''' \end{vmatrix},$$

the sign $\pm$ being in each case such that the sign of the term $\pm ab'.c''d'''e''''$ obtained from the diagonal elements of the component determinants may be the actual sign of this term in the determinant of the fifth order; for the product written down the sign is obviously $+$.

Observe that for a determinant of the n-th order, taking the decomposition to be $1 + (n-1)$, we fall back upon the equations given at the commencement, in order to show the genesis of a determinant.

8. Any determinant $\begin{vmatrix} a, & b \\ a', & b' \end{vmatrix}$ formed out of the elements of the original determinant, by selecting the lines and columns at pleasure, is termed a *minor* of the original determinant; and when the number of lines and columns, or order of the determinant, is $n-1$, then such determinant is called a *first minor*; the number of the first minors is $= n^2$, the first minors, in fact, corresponding to the several elements of the determinant—that is, the coefficient therein of any term whatever is the corresponding first minor. The first minors, each divided by the determinant itself, form a system of elements *inverse* to the elements of the determinant.

A determinant is *symmetrical* when every two elements symmetrically situated in regard to the dexter diagonal are equal to each other; if they are equal and opposite (that is, if the sum of the two elements be = 0), this relation not extending to the diagonal elements themselves, which remain arbitrary, then the determinant is *skew*; but if the relation does extend to the diagonal terms (that is, if these are each = 0), then the determinant is *skew symmetrical*; thus the determinants

$$\begin{vmatrix} a, & h, & g \\ h, & b, & f \\ g, & f, & c \end{vmatrix}; \quad \begin{vmatrix} a, & \nu, & -\mu \\ -\nu, & b, & \lambda \\ \mu, & -\lambda, & c \end{vmatrix}; \quad \begin{vmatrix} 0, & \nu, & -\mu \\ -\nu, & 0, & \lambda \\ \mu, & -\lambda, & 0 \end{vmatrix}$$

are respectively symmetrical, skew and skew symmetrical.

[1] The reason is the connexion with the corresponding theorem for the multiplication of two matrices.

The theory admits of very extensive algebraic developments, and applications in algebraical geometry and other parts of mathematics. For further developments of the theory of determinants see ALGEBRAIC FORMS. (A. CA.)

9. *History*.—These functions were originally known as "resultants," a name applied to them by Pierre Simon Laplace, but now replaced by the title "determinants," a name first applied to certain forms of them by Carl Friedrich Gauss. The germ of the theory of determinants is to be found in the writings of Gottfried Wilhelm Leibnitz (1693), who incidentally discovered certain properties when reducing the eliminant of a system of linear equations. Gabriel Cramer, in a note to his *Analyse des lignes courbes algébriques* (1750), gave the rule which establishes the sign of a product as *plus* or *minus* according as the number of displacements from the typical form has been even or odd. Determinants were also employed by Étienne Bezout in 1764, but the first connected account of these functions was published in 1772 by Charles Auguste Vandermonde. Laplace developed a theorem of Vandermonde for the expansion of a determinant, and in 1773 Joseph Louis Lagrange, in his memoir on *Pyramids*, used determinants of the third order, and proved that the square of a determinant was also a determinant. Although he obtained results now identified with determinants, Lagrange did not discuss these functions systematically. In 1801 Gauss published his *Disquisitiones arithmeticae*, which, although written in an obscure form, gave a new impetus to investigations on this and kindred subjects. To Gauss is due the establishment of the important theorem, that the product of two determinants both of the second and third orders is a determinant. The formulation of the general theory is due to Augustin Louis Cauchy, whose work was the forerunner of the brilliant discoveries made in the following decades by Hoéné-Wronski and J. Binet in France, Carl G[illegible] Jacobi in Germany, and James Joseph Sylvester and Arthur [illegible] in England. Jacobi's researches were published in *Crelle's* [illegible]d (1826–1841). In these papers the subject was recast and [illegible]obi by new and important theorems, through which the name [illegible] far- is indissolubly associated with this branch of science [illegible] most reaching discoveries of Sylvester and Cayley rank as one [illegible] new important developments of pure mathematics. N[illegible] many fields were opened up, and have been diligently exp[illegible] Cayley; mathematicians. Skew-determinants were studie[illegible] Sylvester axisymmetric-determinants by Jacobi, V. A. Leb[illegible] F. Scott and O. Hesse, and centro-symmetric determinants [illegible] Sylvester; and G. Zehfuss. Continuants have been discu[illegible] ach and alternants by Cauchy, Jacobi, N. Trudi, [illegible] d J. W. L. G. Garbieri; circulants by E. Catalan, W. Spott[illegible] Frobenius. Glaisher, and Wronskians by E. B. Christoff[illegible] een studied Determinants composed of binomial coeffici[illegible] determinants by V. von Zeipel; the expression of definite [illegible] of continued by A. Tissot and A. Enneper, and the [illegible] Günther and fractions as determinants by Jacobi, V. N[illegible] 1906.) E. Fürstenau. (See T. Muir, *Theory of D*[illegible] e or limit), in

DETERMINISM (Lat. *determinare*, [illegible] neral choice, so ethics, the name given to the theor[illegible] sychological and called, is the determined or necess[illegible] doctrines of Free- other conditions. It is opposed to [illegible] determinism, and Will, known as voluntarism, lib[illegible] to necessitarianism is from the ethical standpoint mo[illegible] of determinism. It and fatalism. There are vari[illegible] connected not only may be held that every actio[illegible] vironment, but also externally with the sum of [illegible] In other words, if internally with his motives [illegible] we should be able we could know exactly all [illegible] the course which the to forecast with mathema[illegible] agent cannot be held agent would pursue. In [illegible] It is the extreme responsible for his actio[illegible] ism, the doctrine that a antithesis of Indetermi[illegible] alternative courses (the man is absolutely free [illegible], however, the evidence *liberum arbitrium in*[illegible] ys goes to prove that the of ordinary conscio[illegible] ture acts, regards himself individual, especi[illegible] ns to make his own choice as being free wit[illegible] go so far as to admit that of alternatives, [illegible] neither reflex nor determined there may be in[illegible] nt of freedom. This view is by external ca[illegible] of remorse, in which the agent corroborated [illegible] have chosen a different course feels that h[illegible] determinism are sometimes of action. [illegible] soft" determinism. The con- distinguis[illegible] as "h[illegible] and libertarianism hinges largely troversy [illegible]ween d[illegible] "motive"; indeed in no other on the [illegible]ficance [illegible] so much difficulty been caused philoso[illegible]al con[illegible] by purely verbal disputation and ambiguity of expression. How far, and in what sense, can action which is determined by motives be said to be free? For a long time the advocates of free-will, in their eagerness to preserve moral responsibility, went so far as to deny all motives as influencing moral action. Such a contention, however, clearly defeats its own object by reducing all action to chance. On the other hand, the scientific doctrine of evolution has gone far towards obliterating the distinction between external and internal compulsion, *e.g.* motives, character and the like. [illegible] so far as man can be shown to be the product of, and a link [illegible], a long chain of causal development, so far does it become impossible to regard him as self-determined. Even in his motiv[illegible] and his impulses, in his mental attitude towards outward [illegible]roundings, in his appetites and aversions, inherited tendenc[illegible]nd environment have been found to play a very large part; [illegible]eed many thinkers hold that the whole of a man's devel[illegible]ent, mental as well as physical, is determined by ext[illegible] conditions.

[illegible] the Bible the philosophical-religious problem is nowhere [illegible]ssed, but Christian ethics as set forth in the New Testament [illegible]mes throughout the freedom of the human will. It has been [illegible]ued by theologians that the doctrine of divine fore-knowledge, [illegible]upled with that of the divine origin of all things, necessarily [illegible]mplies that all human action was fore-ordained from the beginning of the world. Such an inference is, however, clearly at variance with the whole doctrine of sin, repentance and the atonement, as also with that of eternal reward and punishment, which postulates a real measure of human responsibility.

For the history of the free-will controversy see the articles, WILL, PREDESTINATION (for the theological problems), ETHICS.

DETINUE (O. Fr. *detenue*, from *detenir*, to hold back), in law, an action whereby one who has an absolute or a special property in goods seeks to recover from another who is in actual possession and refuses to redeliver them. If the plaintiff succeeds in an action of detinue, the judgment is that he recover the chattel or, if it cannot be had, its value, which is assessed by the judge and jury, and also certain damages for detaining the same. An order for the restitution of the specific goods may be enforced by a special writ of execution, called a writ of delivery. (See CONTRACT; TROVER.)

DETMOLD, a town of Germany, capital of the principality of Lippe-Detmold, beautifully situated on the east slope of the Teutoburger Wald, 25 m. S. of Minden, on the Herford-Altenbeken line of the Prussian state railways. Pop. (1905) 13,164. The residential château of the princes of Lippe-Detmold (1550), in the Renaissance style, is an imposing building, lying with its pretty gardens nearly in the centre of the town; whilst at the entrance to the large park on the south is the New Palace (1708–1718), enlarged in 1850, used as the dower-house. Detmold possesses a natural history museum, theatre, high school, library, the house in which the poet Ferdinand Freiligrath (1810–1876) was born, and that in which the dramatist Christian Dietrich Grabbe (1801–1836), also a native, died. The leading industries are linen-weaving, tanning, brewing, horse-dealing and the quarrying of marble and gypsum. About 3 m. to the south-west of the town is the Grotenburg, with Ernst von Bandel's colossal statue of Hermann or Arminius, the leader of the Cherusci. Detmold (Thiatmelli) was in 783 the scene of a conflict between the Saxons and the troops of Charlemagne.

DETROIT, the largest city of Michigan, U.S.A., and the county-seat of Wayne county, on the Detroit river opposite Windsor, Canada, about 4 m. W. from the outlet of Lake St Clair and 18 m. above Lake Erie. Pop. (1880) 116,340; (1890) 205,876; (1900) 285,704, of whom 96,503 were foreign-born and 4111 were negroes; (1910, census) 465,766. Of the foreign-born in 1900, 32,027 were Germans and 10,703 were German Poles, 25,403 were English Canadians and 3541 French Canadians, 6347 were English and 6412 were Irish. Detroit is served by the Michigan Central, the Lake Shore & Michigan Southern, the Wabash, the Grand Trunk, the Père Marquette, the Detroit & Toledo Shore Line, the Detroit, Toledo & Ironton and the Canadian Pacific railways. Two belt lines, one 2 m. to 3 m., and

the other 6 m. from the centre of the city, connect the factory districts with the main railway lines. Trains are ferried across the river to Windsor, and steamboats make daily trips to Cleveland, Wyandotte, Mount Clemens, Port Huron, to less important places between, and to several Canadian ports. Detroit is also the S. terminus for several lines to more remote lake ports, and electric lines extend from here to Port Huron, Flint, Pontiac, Jackson, Toledo and Grand Rapids.

The city extended in 1907 over about 41 sq. m., an increase from 49 sq. m. in 1900 and 36 sq. m. in 1905. Its area in proportion to its population is much greater than that of most of the larger cities of the United States. Baltimore, for example, had in 1904 nearly 70 % more inhabitants (estimated), while its area at that time was a little less and in 1907 was nearly one-quarter less than that of Detroit. The ground within the city limits as well as that for several miles farther back is quite level but rises gradually from the river bank, which is only a few feet in height. The Detroit river, along which the city extends for about 10 m., is here ½ m. wide and 30 ft. to 40 ft. deep; its current is quite rapid; its water, a beautiful clear blue; at its mouth it has a width of about 10 m., and in the river there are a number of islands, which during the summer are popular resorts. The city has a 3 m. frontage on the river Rouge, an estuary of the Detroit, with a 16 ft. channel. Before the fire by which the city was destroyed in 1805, the streets were only 12 ft. wide and were unpaved and extremely dirty. But when the rebuilding began, several avenues from 100 ft. to 200 ft. wide were—through the influence of Augustus B. Woodward (*c.* 1775–1827), one of the territorial judges at the time and an admirer of the plan of the city of Washington—made to radiate from two central points. From a half circle called the Grand Circus there radiate avenues 120 ft. and 200 ft. wide. About ¼ m. toward the river from this was established another focal point called the Campus Martius, 600 ft. long and 400 ft. wide, at which commence radiating or cross streets 80 ft. and 100 ft. wide. Running north from the river through the Campus Martius and the Grand Circus is Woodward Avenue, 120 ft. wide, dividing the present city, as it did the old town, into nearly equal parts. Parallel with the river is Jefferson Avenue, also 120 ft. wide. The first of these avenues is the principal retail street along its lower portion, and is a residence avenue for 4 m. beyond this. Jefferson is the principal wholesale street at the lower end, and a fine residence avenue E. of this. Many of the other residence streets are 80 ft. wide. The setting of shade trees was early encouraged, and large elms and maples abound. The intersections of the diagonal streets left a number of small, triangular parks, which, as well as the larger ones, are well shaded. The streets are paved mostly with asphalt and brick, though cedar and stone have been much used, and kreodone block to some extent. In few, if any, other American cities of equal size are the streets and avenues kept so clean. The Grand Boulevard, 150 ft. to 200 ft. in width and 12 m. in length, has been constructed around the city except along the river front. A very large proportion of the inhabitants of Detroit own their homes: there are no large congested tenement-house districts; and many streets in various parts of the city are faced with rows of low and humble cottages often having a garden plot in front.

Of the public buildings the city hall (erected 1868-1871), overlooking the Campus Martius, is in Renaissance style, in three storeys; the flagstaff from the top of the tower reaches a height of 200 ft. On the four corners above the first section of the tower are four figures, each 14 ft. in height, to represent Justice, Industry, Art and Commerce, and on the same level with these is a clock weighing 7670 lb—one of the largest in the world. In front of the building stands the Soldiers' and Sailors' monument, 60 ft. high, designed by Randolph Rogers (1825–1892) and unveiled in 1872. At each of the four corners in each of three sections rising one above the other are bronze eagles and figures representing the United States Infantry, Marine, Cavalry and Artillery, also Victory, Union, Emancipation and History; the figure by which the monument is surmounted was designed to symbolize Michigan. A larger and more massive and stately building than the city hall is the county court house, facing Cadillac Square, with a lofty tower surmounted by a gilded dome. The Federal building is a massive granite structure, finely decorated in the interior. Among the churches of greatest architectural beauty are the First Congregational, with a fine Byzantine interior, St John's Episcopal, the Woodward Avenue Baptist and the First Presbyterian, all on Woodward Avenue, and St Anne's and Sacred Heart of Mary, both Roman Catholic. The municipal museum of art, in Jefferson Avenue, contains some unusually interesting Egyptian and Japanese collections, the Scripps' collection of old masters, other valuable paintings, and a small library; free lectures on art are given here through the winter. The public library had 228,500 volumes in 1908, including one of the best collections of state and town histories in the country. A large private collection, owned by C. M. Burton and relating principally to the history of Detroit, is also open to the public. The city is not rich in outdoor works of art. The principal ones are the Merrill fountain and the soldiers' monument on the Campus Martius, and a statue of Mayor Pingree in West Grand Circus Park.

The parks of Detroit are numerous and their total area is about 1200 acres. By far the most attractive is Belle Isle, an island in the river at the E. end of the city, purchased in 1879 and having an area of more than 700 acres. The Grand Circus Park of 4½ acres, with its trees, flowers and fountains, affords a pleasant resting place in the busiest quarter of the city. Six miles farther out on Woodward Avenue is Palmer Park of about 140 acres, given to the city in 1894 and named in honour of the donor. Clark Park (28 acres) is in the W. part of the city, and there are various smaller parks. The principal cemeteries are Elmwood (Protestant) and Mount Elliott (Catholic), which lie adjoining in the E. part of the city; Woodmere in the W. and Woodlawn in the N. part of the city.

Charity and Education.—Among the charitable institutions are the general hospitals (Harper, Grace and St Mary's); the Detroit Emergency, the Children's Free and the United States Marine hospitals; St Luke's hospital, church home, and orphanage; the House of Providence (a maternity hospital and infant asylum); the Woman's hospital and foundling's home; the Home for convalescent children, &c. In 1894 the mayor, Hazen Senter Pingree (1842–1901), instituted the practice of preparing, through municipal aid and supervision, large tracts of vacant land in and about the city for the growing of potatoes and other vegetables and then, in conjunction with the board of poor commissioners, assigning it in small lots to families of the unemployed, and furnishing them with seed for planting. This plan served an admirable purpose through three years of industrial depression, and was copied in other cities; it was abandoned when, with the renewal of industrial activity, the necessity for it ceased. The leading penal institution of the city is the Detroit House of Correction, noted for its efficient reformatory work; the inmates are employed ten hours a day, chiefly in making furniture. The house of correction pays the city a profit of $35,000 to $40,000 a year. The educational institutions, in addition to those of the general public school system, include several parochial schools, schools of art and of music, and commercial colleges; Detroit College (Catholic), opened in 1877; the Detroit College of Medicine, opened in 1885; the Michigan College of Medicine and Surgery, opened in 1888; the Detroit College of law, founded in 1891, and a city normal school.

Commerce.—Detroit's location gives to the city's shipping and shipbuilding interests a high importance. All the enormous traffic between the upper and lower lakes passes through the Detroit river. In 1907 the number of vessels recorded was 34,149, with registered tonnage of 53,959,769, carrying 71,226,895 tons of freight, valued at $697,311,302. This includes vessels which delivered part or all of their cargo at Detroit. The largest item in the freights is iron ore on vessels bound down. The next is coal on vessels up bound. Grain and lumber are the next largest items. Detroit is a port of entry, and its foreign commerce, chiefly with Canada, is of growing importance. The city's exports increased from $11,325,807 in 1896 to $40,488,295 in

1907. The imports were $3,153,609 in 1896 and $6,252,034 in 1907.

As a manufacturing city, Detroit holds high rank. The total number of manufacturing establishments in 1890 was 1746, with a product for the year valued at $77,351,546; in 1900 there were 2847 establishments with a product for the year valued at $100,892,838, or an increase of 30·4 % in the decade. In 1900 the establishments under the factory system, omitting the hand trades and neighbourhood industries, numbered 1259 and produced goods valued at $88,365,924; in 1904 establishments under the factory system numbered 1363 and the product had increased 45·7 % to $128,761,658. In the district subsequently annexed the product in 1904 was about $12,000,000, making a total of $140,000,000. The output for 1906 was estimated at $180,000,000. The state factory inspectors in 1905 visited 1721 factories having 83,231 employees. In 1906 they inspected 1790 factories with 93,071 employees. Detroit is the leading city in the country in the manufacture of automobiles. In 1904 the value of its product was one-fifth that for the whole country. In 1906 the city had twenty automobile factories, with an output of 11,000 cars, valued at $12,000,000. Detroit is probably the largest manufacturer in the country of freight cars, stoves, pharmaceutical preparations, varnish, soda ash and similar alkaline products. Other important manufactures are ships, paints, foundry and machine shop products, brass goods, furniture, boots and shoes, clothing, matches, cigars, malt liquors and fur goods; and slaughtering and meat packing is an important industry.

The Detroit Board of Commerce, organized in 1903, brought into one association the members of three former bodies, making a compact organization with civic as well as commercial aims. The board has brought into active co-operation nearly all the leading business men of the city and many of the professional men. Their united efforts have brought many new industries to the city, have improved industrial conditions, and have exerted a beneficial influence upon the municipal administration. Other business organizations are the Board of Trade, devoted to the grain trade and kindred lines, the Employers' Association, which seeks to maintain satisfactory relations between employer and employed, the Builders' & Traders' Exchange, and the Credit Men's Association.

Administration.—Although the city received its first charter in 1806, and another in 1815, the real power rested in the hands of the governor and judges of the territory until 1824; the charters of 1824 and 1827 centred the government in a council and made the list of elective officers long; the charter of 1827 was revised in 1857 and again in 1859 and the present charter dates from 1883. Under this charter only three administrative officers are elected,—the mayor, the city clerk and the city treasurer,—elections being biennial. The administration of the city departments is largely in the hands of commissions. There is one commissioner each, appointed by the mayor, for the parks and boulevards, police and public works departments. The four members of the health board are nominated by the governor and confirmed by the state senate. The school board is an independent body, consisting of one elected member from each ward holding office for four years, but the mayor has the veto power over its proceedings as well as those of the common council. In each case a two-thirds vote overrules his veto. The other principal officers and commissions, appointed by the mayor and confirmed by the council, are controller, corporation counsel, board of three assessors, fire commission (four members), public lighting commission (six members), water commission (five members), poor commission (four members), and inspectors of the house of correction (four in number). The members of the public library commission, six in number, are elected by the board of education. Itemized estimates of expenses for the next fiscal year are furnished by the different departments to the controller in February. He transmits them to the common council with his recommendations. The council has four weeks in which to consider them. It may reduce or increase the amounts asked, and may add new items. The budget then goes to the board of estimates, which has a month for its consideration. This body consists of two members elected from each ward and five elected at large. The mayor and heads of departments are advisory members, and may speak but not vote. The members of the board of estimates can hold no other office and they have no appointing power, the intention being to keep them as free as possible from all political motives and influences. They may reduce or cut out any estimates submitted, but cannot increase any or add new ones. No bonds can be issued without the assent of the board of estimates. The budget is apportioned among twelve committees which have almost invariably given close and conscientious examination to the actual needs of the departments. A reduction of $1,000,000 to $1,500,000, without impairing the service, has been a not unusual result of their deliberations. Prudent management under this system has placed the city in the highest rank financially. Its debt limit is 2 % on the assessed valuation, and even that low maximum is not often reached. The debt in 1907 was only about $5,500,000, a smaller *per capita* debt than that of any other city of over 100,000 inhabitants in the country; the assessed valuation was $330,000,000; the city tax, $14·70 on the thousand dollars of assessed valuation. Both the council and the estimators are hampered in their work by legislative interference. Nearly all the large salaries and many of those of the second grade are made mandatory by the legislature, which has also determined many affairs of a purely administrative character.

Detroit has made three experiments with municipal ownership. On account of inadequate and unsatisfactory service by a private company, the city bought the water-works as long ago as 1836. The works have been twice moved and enlargements have been made in advance of the needs of the city. In 1907 there were six engines in the works with a pumping capacity of 152,000,000 gallons daily. The daily average of water used during the preceding year was 61,357,000 gallons. The water is pumped from Lake St Clair and is of exceptional purity. The city began its own public lighting in April 1895, having a large plant on the river near the centre of the city. It lights the streets and public buildings, but makes no provision for commercial business. The lighting is excellent, and the cost is probably less than could be obtained from a private company. The street lighting is done partly from pole and arm lights, but largely from steel towers from 100 ft. to 180 ft. in height, with strong reflected lights at the top. The city also owns two portable asphalt plants, and thus makes a saving in the cost of street repairing and resurfacing. With a view of effecting the reduction of street car fares to three cents, the state legislature in 1899 passed an act for purchasing or leasing the street railways of the city, but the Supreme Court pronounced this act unconstitutional on the ground that, as the constitution prohibited the state from engaging in a work of internal improvement, the state could not empower a municipality to do so. Certain test votes indicated an almost even division on the question of municipal ownership of the railways.

History.—Detroit was founded in 1701 by Antoine Laumet de la Mothe Cadillac (*c.* 1661–1730), who had pointed out the importance of the place as a strategic point for determining the control of the fur trade and the possession of the North-west and had received assistance from the French government soon after Robert Livingston (1654–1725), the secretary of the Board of Indian Commissioners in New York, had urged the English government to establish a fort at the same place. Cadillac arrived on the 24th of July with about 100 followers. They at once built a palisade fort about 200 ft. square S. of what is now Jefferson Avenue and between Griswold and Shelby streets, and named it Fort Pontchartrain in honour of the French colonial minister. Indians at once came to the place in large numbers, but they soon complained of the high price of French goods; there was serious contention between Cadillac and the French Canadian Fur Company, to which a monopoly of the trade had been granted, as well as bitter rivalry between him and the Jesuits. After the several parties had begun to complain to the home government the monopoly of the fur trade was transferred to Cadillac and he was exhorted to cease quarrelling with the

Jesuits. Although the inhabitants then increased to 200 or more, dissatisfaction with the paternal rule of the founder increased until 1710, when he was made governor of Louisiana. The year before, the soldiers had been withdrawn; by the second year after there was serious trouble with the Indians, and for several years following the population was greatly reduced and the post threatened with extinction. But in 1722, when the Mississippi country was opened, the population once more increased, and again in 1748, when the settlement of the Ohio Valley began, the governor-general of Canada offered special inducements to Frenchmen to settle at Detroit, with the result that the population was soon more than 1000 and the cultivation of farms in the vicinity was begun. In 1760, however, the place was taken by the British under Colonel Robert Rogers and an English element was introduced into the population which up to this time had been almost exclusively French. Three years later, during the conspiracy of Pontiac, the fort first narrowly escaped capture and then suffered from a siege lasting from the 9th of May until the 12th of October. Under English rule it continued from this time on as a military post with its population usually reduced to less than 500. In 1778 a new fort was built and named Fort Lernault, and during the War of Independence the British sent forth from here several Indian expeditions to ravage the frontiers. With the ratification of the treaty which concluded that war the title to the post passed to the United States in 1783, but the post itself was not surrendered until the 11th of January 1796, in accordance with Jay's Treaty of 1794. It was then named Fort Shelby; but in 1802 it was incorporated as a town and received its present name. In 1805 all except one or two buildings were destroyed by fire. General William Hull (1753–1825), a veteran of the War of American Independence, governor of Michigan territory in 1805–1812, as commander of the north-western army in 1812 occupied the city. Failing to hear immediately of the declaration of war between the United States and Great Britain, he was cut off from his supplies shipped by Lake Erie. He made from Detroit on the 12th of July an awkward and futile advance into Canada, which, if more vigorous, might have resulted in the capture of Malden and the establishment of American troops in Canada, and then retired to his fortifications. On the 16th of August 1812, without any resistance and without consulting his officers, he surrendered the city to General Brock, for reasons of humanity, and afterwards attempted to justify himself by criticism of the War Department in general and in particular of General Henry Dearborn's armistice with Prevost, which had not included in its terms Hull, whom Dearborn had been sent out to reinforce.[1] After Perry's victory on the 14th of September on Lake Erie, Detroit on the 29th of September was again occupied by the forces of the United States. Its growth was rather slow until 1830, but since then its progress has been unimpeded. Detroit was the capital of Michigan from 1805 to 1847.

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DETTINGEN, a village of Germany in the kingdom of Bavaria, on the Main, and on the Frankfort-on-Main-Aschaffenburg railway, 10 m. N.W. of Aschaffenburg. It is memorable as the scene of a decisive battle on the 27th of June 1743, when the English, Hanoverians and Austrians (the "Pragmatic army"), 42,000 men under the command of George II. of England, routed the numerically superior French forces under the duc de Noailles. It was in memory of this victory that Handel composed his *Dettingen Te Deum*.

[1] Hull was tried at Albany in 1814 by court martial, General Dearborn presiding, was found guilty of treason, cowardice, neglect of duty and unofficerlike conduct, and was sentenced to be shot; the president remitted the sentence because of Hull's services in the Revolution.

DEUCALION, in Greek legend, son of Prometheus, king of Phthia in Thessaly, husband of Pyrrha, and father of Hellen, the mythical ancestor of the Hellenic race. When Zeus had resolved to destroy all mankind by a flood, Deucalion constructed a boat or ark, in which, after drifting nine days and nights, he landed on Mount Parnassus (according to others, Othrys, Aetna or Athos) with his wife. Having offered sacrifice and inquired how to renew the human race, they were ordered to cast behind them the "bones of the great mother," that is, the stones from the hillside. The stones thrown by Deucalion became men, those thrown by Pyrrha, women.

See Apollodorus i. 7, 2; Ovid, *Metam.* i. 243-415; Apollonius Rhodius iii. 1085 ff.; H. Usener, *Die Sintflutsagen* (1899).

DEUCE (a corruption of the Fr. *deux*, two), a term applied to the "two" of any suit of cards, or of dice. It is also a term used in tennis when both sides have each scored three points in a game, or five games in a set; to win the game or set two points or games must then be won consecutively. The earliest instances in English of the use of the slang expression "the deuce," in exclamations and the like, date from the middle of the 17th century. The meaning was similar to that of "plague" or "mischief" in such phrases as "plague on you," "mischief take you" and the like. The use of the word as an euphemism for "the devil" is later. According to the *New English Dictionary* the most probable derivation is from a Low German *das daus, i.e.* the "deuce" in dice, the lowest and therefore the most unlucky throw. The personification, with a consequent change of gender, to *der daus*, came later. The word has also been identified with the name of a giant or goblin in Teutonic mythology.

DEUS, JOÃO DE (1830–1896), the greatest Portuguese poet of his generation, was born at San Bartholomeu de Messines in the province of Algarve on the 8th of March 1830. Matriculating in the faculty of law at the university of Coimbra, he did not proceed to his degree but settled in the city, dedicating himself wholly to the composition of verses, which circulated among professors and undergraduates in manuscript copies. In the volume of his art, as in the conduct of life, he practised a rigorous self-control. He printed nothing previous to 1855, and the first of his poems to appear in a separate form was *La Lata*, in 1860. In 1862 he left Coimbra for Beja, where he was appointed editor of *O Bejense*, the chief newspaper in the province of Alemtejo, and four years later he edited the *Folha do Sul*. As the pungent satirical verses entitled *Eleições* prove, he was not an ardent politician, and, though he was returned as Liberal deputy for the constituency of Silves in 1869, he acted independently of all political parties and promptly resigned his mandate. The renunciation implied in the act, which cut him off from all advancement, is in accord with nearly all that is known of his lofty character. In the year of his election as deputy, his friend José Antonio Garcia Blanco collected from local journals the series of poems, *Flores do campo*, which is supplemented by the *Ramo de flores* (1869). This is João de Deus's masterpiece. *Pires de Marmalada* (1869) is an improvisation of no great merit. The four theatrical pieces—*Amemos o nosso proximo*, *Ser apresentado*, *Ensaio de Casamento*, and *A Viúva inconsolavel*—are prose translations from Méry, cleverly done, but not worth the doing. *Horacio e Lydia* (1872), a translation from Ponsard, is a good example of artifice in manipulating that dangerously monotonous measure, the Portuguese couplet. As an indication of a strong spiritual reaction three prose fragments (1873)—*Anna, Mãe de Maria*, *A Virgem Maria* and *A Mulher do Levita de Ephrain*—translated from Darboy's *Femmes de la Bible*, are full of significance. The *Folhas soltas* (1876) is a collection of verse in the manner of *Flores do campo*, brilliantly effective and exquisitely refined. Within the next few years the writer turned his attention to educational problems, and in his *Cartilha maternal* (1876) first expressed the conclusions to which his study of Pestalozzi and Fröbel had led him. This patriotic, pedagogical apostolate was a misfortune for Portuguese literature; his educational mission absorbed João de Deus completely, and is responsible for numerous controversial letters, for a translation of Théodore-Henri Barrau's treatise, *Des devoirs des enfants envers leurs*

parents, for a prosodic dictionary and for many other publications of no literary value. A copy of verses in Antonio Vieira's *Grinalda de Maria* (1877), the *Loas á Virgem* (1878) and the *Proverbios de Salomão* are evidence of a complete return to orthodoxy during the poet's last years. By a lamentable error of judgment some worthless pornographic verses entitled *Cryptinas* have been inserted in the completest edition of João de Deus's poems—*Campo de Flores* (Lisbon, 1893). He died at Lisbon on the 11th of January 1896, was accorded a public funeral and was buried in the National Pantheon, the Jeronymite church at Belem, where repose the remains of Camoens, Herculano and Garrett. His scattered minor prose writings and correspondence have been posthumously published by Dr Theophilo Braga (Lisbon, 1898).

Next to Camoens and perhaps Garrett, no Portuguese poet has been more widely read, more profoundly admired than João de Deus; yet no poet in any country has been more indifferent to public opinion and more deliberately careless of personal fame. He is not responsible for any single edition of his poems, which were put together by pious but ill-informed enthusiasts, who ascribed to him verses that he had not written; he kept no copies of his compositions, seldom troubled to write them himself, and was content for the most part to dictate them to others. He has no great intellectual force, no philosophic doctrine, is limited in theme as in outlook, is curiously uncertain in his touch, often marring a fine poem with a slovenly rhyme or with a misplaced accent; and, on the only occasion when he was induced to revise a set of proofs, his alterations were nearly all for the worse. And yet, though he never appealed to the patriotic spirit, though he wrote nothing at all comparable in force or majesty to the restrained splendour of *Os Lusiadas*, the popular instinct which links his name with that of his great predecessor is eminently just. For Camoens was his model; not the Camoens of the epic, but the Camoens of the lyrics and the sonnets, where the passion of tenderness finds its supreme utterance. Braga has noted five stages of development in João de Deus's artistic life—the imitative, the idyllic, the lyric, the pessimistic and the devout phases. Under each of these divisions is included much that is of extreme interest, especially to contemporaries who have passed through the same succession of emotional experience, and it is highly probable that *Caturras* and *Gaspar*, pieces as witty as anything in Bocage but free from Bocage's coarse impiety, will always interest literary students. But it is as the singer of love that João de Deus will delight posterity as he delighted his own generation. The elegiac music of *Rachel* and of *Marina*, the melancholy of *Adeus* and of *Remoinho*, the tenderness and sincerity of *Meu casto lirio*, of *Lagrima celeste*, of *Descalça*, and a score more songs are distinguished by the large, vital simplicity which withstands time. It is precisely in the quality of unstudied simplicity that João de Deus is incomparably strong. The temptations to a display of virtuosity are almost irresistible for a Portuguese poet; he has the tradition of virtuosity in his blood, he has before him the example of all contemporaries, and he has at hand an instrument of wonderful sonority and compass. Yet not once is João de Deus clamorous or rhetorical, not once does he indulge in idle ornament. His prevailing note is that of exquisite sweetness and of reverent purity; yet with all his caressing softness he is never sentimental, and, though he has not the strength for a long fight, emotion has seldom been set to more delicate music. Had he included among his other gifts the gift of selection, had he continued the poetic discipline of his youth instead of dedicating his powers to a task which, well as he performed it, might have been done no less well by a much lesser man, there is scarcely any height to which he might not have risen.

See also Maxime Formont, *Le Mouvement poétique contemporain en Portugal* (Lyon, 1892). (J. F.-K.)

DEUTERONOMY, the name of one of the books of the Old Testament. This book was long the storm-centre of Pentateuchal criticism, orthodox scholars boldly asserting that any who questioned its Mosaic authorship reduced it to the level of a pious fraud. But Biblical facts have at last triumphed over tradition, and the non-Mosaic authorship of Deuteronomy is now a commonplace of criticism. It is still instructive, however, to note the successive phases through which scholarly opinion regarding the composition and date of this book has passed.

In the 17th century the characteristics which so clearly mark off Deuteronomy from the other four books of the Pentateuch were frankly recognized, but the most advanced critics of that age were inclined to pronounce it the earliest and most authentic of the five. In the beginning of the 19th century de Wette startled the religious world by declaring that Deuteronomy, so far from being Mosaic, was not known till the time of Josiah. This theory he founded on 2 Kings xxii.; and ever since, this chapter has been one of the recognized foci of Biblical criticism. The only other single chapter of the Bible which is responsible for having brought about a somewhat similar revolution in critical opinion is Ezek. xliv. From this chapter, some seventy years after de Wette's discovery, Wellhausen with equal acumen inferred that Leviticus was not known to Ezekiel, the priest, and therefore could not have been in existence in his day; for had Leviticus been the recognized Law-book of his nation Ezekiel could not have represented as a degradation the very position which that Law-book described as a special honour conferred on the Levites by Yahweh himself. Hence Leviticus, so far from belonging to an earlier stratum of the Pentateuch than Deuteronomy, as de Wette thought, must belong to a much later stratum, and be at least exilic, if not post-exilic.

The title "Deuteronomy" is due to a mistranslation by the Septuagint of the clause in chap. xvii. 18, rendered "and he shall write out for himself this Deuteronomy." The Hebrew really means "and he [the king] shall write out for himself a copy of this law," where there is not the slightest suggestion that the author intended to describe "this law" delivered on the plains of Moab as a second code in contradistinction to the first code given on Sinai thirty-eight years earlier. Moreover the phrase "this law" is so ambiguous as to raise a much greater difficulty than that caused by the Greek mistranslation of the Hebrew word for "copy." How much does "this law" include? It was long supposed to mean the whole of our present Deuteronomy; indeed, it is on that supposition that the traditional view of the Mosaic authorship is based. But the context alone can determine the question; and that is often so ambiguous that a sure inference is impossible. We may safely assert, however, that nowhere need "this law" mean the whole book. In fact, it invariably means very much less, and sometimes, as in xxvii. 3, 8, so little that it could all be engraved in large letters on a few plastered stones set up beside an altar.

Deuteronomy is not the work of any single writer but the result of a long process of development. The fact that it is legislative as well as hortatory is enough to prove this, for most of the laws it contains are found elsewhere in the Pentateuch, sometimes in less developed, sometimes in more developed forms, a fact which is conclusive proof of prolonged historical development. According to the all-pervading law of evolution, the less complex form must have preceded the more complex. Still, the book does bear the stamp of one master-mind. Its style is as easily recognized as that of Deutero-Isaiah, being as remarkable for its copious diction as for its depths of moral and religious feeling.

The original Deuteronomy, D, read to King Josiah, cannot have been so large as our present book, for not only could it be read at a single sitting, but it could be easily read twice in one day. On the day it was found, Shaphan first read it himself, and then went to the king and read it aloud to him. But perhaps the most conclusive proof of its brevity is that it was read publicly to the assembled people immediately before they, as well as their king, pledged themselves to obey it; and not a word is said as to the task of reading it aloud, so as to be heard by such a great multitude, being long or difficult.

The legislative part of D consists of fifteen chapters (xii.–xxvi.), which, however, contain many later insertions. But the impression made upon Josiah by what he heard was far too deep to have been produced by the legislative part alone. The king must have listened to the curses as well as the blessings in chap. xxviii., and

no doubt also to the exhortations in chaps. v.–xi. Hence we may conclude that the original book consisted of a central mass of religious, civil and social laws, preceded by a hortatory introduction and followed by an effective peroration. The book read to Josiah must therefore have comprised most of what is found in Deut. v.–xxvi., xxvii. 9, 10 and xxviii. But something like two centuries elapsed before the book reached its present form, for in the closing chapter, as well as elsewhere, *e.g.* i. 41-43 (where the joining is not so deftly done as usual) and xxxii. 48-52, there are undoubted traces of the Priestly Code, P, which is generally acknowledged to be post-exilic.

The following is an analysis of the main divisions of the book as we now have it. There are two introductions, the first i.–iv. 44, more historical than hortatory; the second v.–xi., more hortatory than historical. These may at first have been prefixed to separate editions of the legislative portion, but were eventually combined. Then, before D was united to P, five appendices of very various dates and embracing poetry as well as prose, were added so as to give a fuller account of the last days of Moses and thus lead up to the narrative of his death with which the book closes. (1) Chap. xxvii., where the elders of Israel are introduced for the first time as acting along with Moses (xxvii. 1) and then the priests, the Levites (xxvii. 9). Some of the curses refer to laws given not in D but in Lev. xxx., so that the date of this chapter must be later than Leviticus or at any rate than the laws codified in the Law of Holiness (Lev. xvii.–xxvi.). (2) The second appendix, chaps. xxix.–xxxi. 29, xxxii. 45-47, gives us the farewell address of Moses and is certainly later than D. Moses is represented as speaking not with any hope of preventing Israel's apostasy but because he knows that the people will eventually prove apostate (xxxi. 29), a point of view very different from D's. (3) The Song of Moses, chap. xxxii. That this didactic poem must have been written late in the nation's history, and not at its very beginning, is evident from v. 7: "Remember the days of old, Consider the years of many generations." Such words cannot be interpreted so as to fit the lips of Moses. It must have been composed in a time of natural gloom and depression, after Yahweh's anger had been provoked by "a very froward generation," certainly not before the Assyrian Empire had loomed up against the political horizon, aggressive and menacing. Some critics bring the date down even to the time of Jeremiah and Ezekiel. (4) The Blessing of Moses, chap. xxxiii. The first line proves that this poem is not by D, who speaks invariably of Horeb, never of Sinai. The situation depicted is in striking contrast with that of the Song. Everything is bright because of promises fulfilled, and the future bids fair to be brighter still. Bruston maintains with reason that the Blessing, strictly so called, consists only of vv. 6-25, and has been inserted in a Psalm celebrating the goodness of Jehovah to his people on their entrance into Canaan (vv. 1-5, 26-29). The special prominence given to Joseph (Ephraim and Manasseh) in vv. 13-17 has led many critics to assign this poem to the time of the greatest warrior-king of Northern Israel, Jeroboam II. (5) The account of Moses' death, chap. xxxiv. This appendix, containing, as it does, manifest traces of P, proves that even Deuteronomy was not put into its present form until after the exile.

From the many coincidences between D and the Book of the Covenant (Ex. xx.–xxiii.) it is clear that D was acquainted with E, the prophetic narrative of the Northern kingdom; but it is not quite clear whether D knew E as an independent work, or after its combination with J, the somewhat earlier prophetic narrative of the Southern kingdom, the combined form of which is now indicated by the symbol JE. Kittel certainly puts it too strongly when he asserts that D quotes always from E and never from J, for some of the passages alluded to in D may just as readily be ascribed to J as to E, cf. Deut. i. 7 and Gen. xv. 18; Deut. x. 14 and Ex. xxxiv. 1-4. Consequently D must have been written certainly after E and possibly after E was combined with J.

In Amos, Hosea and Isaiah there are no traces of D's ideas, whereas in Jeremiah and Ezekiel their influence is everywhere manifest. Hence this school of thought arose between the age of Isaiah and that of Jeremiah; but how long D itself may have been in existence before it was read in 622 to Josiah cannot be determined with certainty. Many argue that D was written immediately before it was found and that, in fact, it was put into the temple for the purpose of being "found." This theory gives some plausibility to the charge that the book is a pious fraud. But the narrative in 2 Kings xxii. warrants no such inference. The more natural explanation is that it was written not in the early years of Josiah's reign, and with the cognizance of the temple priests then in office, but some time during the long reign of Manasseh, probably when his policy was most reactionary and when he favoured the worship of the "host of heaven" and set up altars to strange gods in Jerusalem itself. This explains why the author did not publish his work immediately, but placed it where he hoped it would be safely preserved till opportunity should arise for its publication. One need not suppose that he actually foresaw how favourable that opportunity would prove, and that, as soon as discovered, his work would be promulgated as law by the king and willingly accepted by the people. The author believed that everything he wrote was in full accordance with the mind of Moses, and would contribute to the national weal of Yahweh's covenant people, and therefore he did not scruple to represent Moses as the speaker. It is not to be expected that modern scholars should be able to fix the exact year or even decade in which such a book was written. It is enough to determine with something like probability the century or half-century which best fits its historical data; and these appear to point to the reign of Manasseh.

Between D and P there are no verbal parallels; but in the historical résumés JE is followed closely, whole clauses and even verses being copied practically verbatim. As Dr Driver points out in his careful analysis, there are only three facts in D which are not also found in JE, viz. the number of the spies, the number of souls that went down into Egypt with Jacob, and the ark being made of acacia wood. But even these may have been in J or E originally, and left out when JE was combined with P. Steuernagel divides the legal as well as the hortatory parts of D between two authors, one of whom uses the 2nd person plural when addressing Israel, and the other the 2nd person singular; but as a similar alternation is constantly found in writings universally acknowledged to be by the same author, this clue seems anything but trustworthy, depending as it does on the presence or absence of a single Hebrew letter, and resulting, as it frequently does, in the division of verses which otherwise seem to be from the same pen (cf. xx. 2). The inference as to diversity of authorship is much more conclusive when difference of standpoint can be proved, cf. v. 3, xi. 2 ff. with viii. 2. The first two passages represent Moses as addressing the generation that was alive at Horeb, whereas the last represents him as speaking to those who were about to pass over Jordan a full generation later; and it may well be that the one author may, in the historical and hortatory parts, have preferred the 2nd plural and the other the 2nd singular; without the further inference being justified that every law in which the 2nd singular is used must be assigned to the latter, and every law in which the 2nd plural occurs must be due to the former.

The law of the Single Sanctuary, one of D's outstanding characteristics, is, for him, an innovation, but an innovation towards which events had long been tending. 2 Kings xxiii. 9 shows that even the zeal of Josiah could not carry out the instructions laid down in D xviii. 6-8. Josiah's acceptance of D made it the first canonical book of scripture. Thus the religion of Judah became henceforward a religion which enabled its adherents to learn from a book exactly what was required of them. D requires the destruction not only of the high places and the idols, but of the Asheras (wooden posts) and the Mazzebas (stone pillars) often set up beside the altar of Jehovah (xvi. 21). These reforms made too heavy demands upon the people, as was proved by the reaction which set in at Josiah's death. Indeed the country people would look on the destruction of the high places with their Asheras and Mazzebas as sacrilege and would consider Josiah's death in battle as a divine punishment for his

sacrilegious deeds. On the other hand, the destruction of Jerusalem and the exile of the people would appear to those who had obeyed D's instructions as a well-merited punishment for national apostasy.

Moreover, D regarded religion as of the utmost moment to each individual Israelite; and it is certainly not by accident that the declaration of the individual's duty towards God immediately follows the emphatic intimation to Israel of Yahweh's unity. "Hear, O Israel, Yahweh is our God, Yahweh is one: and thou shalt love Yahweh thy God with all thine heart and with all thy soul and with all thy strength" (vi. 4, 5).

In estimating the religious value of Deuteronomy it should never be forgotten that upon this passage the greatest eulogy ever pronounced on any scripture was pronounced by Christ himself, when he said "on these words hang all the law and the prophets," and it is also well to remember that when tempted in the wilderness he repelled each suggestion of the Tempter by a quotation from Deuteronomy.

Nevertheless even such a writer as D could not escape the influence of the age and atmosphere in which he lived; and despite the spirit of love which breathes so strongly throughout the book, especially for the poor, the widow and the fatherless, the stranger and the homeless Levite (xxiv. 10-22), and the humanity shown towards both beasts and birds (xxii. 1, 4, 6 f., xxv. 4), there are elements in D which go far to explain the intense exclusiveness and the religious intolerance characteristic of Judaism. Should a man's son or friend dear to him as his own soul seek to tempt him from the faith of his fathers, D's pitiless order to that man is "Thou shalt surely kill him; thine hand shall be first upon him to put him to death." From this single instance we see not only how far mankind has travelled along the path of religious toleration since Deuteronomy was written, but also how very far the criticism implied in Christ's method of dealing with what "was said to them of old time" may be legitimately carried. (J. A. P.*)

DEUTSCH, IMMANUEL OSCAR MENAHEM (1829–1873), German oriental scholar, was born on the 28th of October 1829, at Neisse in Prussian Silesia, of Jewish extraction. On reaching his sixteenth year he began his studies at the university of Berlin, paying special attention to theology and the Talmud. He also mastered the English language and studied English literature. In 1855 Deutsch was appointed assistant in the library of the British Museum. He worked intensely on the Talmud and contributed no less than 190 papers to *Chambers's Encyclopaedia*, in addition to essays in Kitto's and Smith's Biblical Dictionaries, and articles in periodicals. In October 1867 his article on "The Talmud," published in the *Quarterly Review*, made him known. It was translated into French, German, Russian, Swedish, Dutch and Danish. He died at Alexandria on the 12th of May 1873.

His *Literary Remains*, edited by Lady Strangford, were published in 1874, consisting of nineteen papers on such subjects as "The Talmud," "Islam," "Semitic Culture," "Egypt, Ancient and Modern," "Semitic Languages," "The Targums," "The Samaritan Pentateuch," and "Arabic Poetry."

DEUTSCHKRONE, a town of Germany, kingdom of Prussia, between the two lakes of Arens and Radau, 15 m. N.W. of Schneidemühl, a railway junction 60 m. north of Posen. Pop. (1905) 7282. It is the seat of the public offices for the district, possesses an Evangelical and a Roman Catholic church, a synagogue, and a gymnasium established in the old Jesuit college, and has manufactures of machinery, woollens, tiles, brandy and beer.

DEUTZ (anc. *Divitio*), formerly an independent town of Germany, in the Prussian Rhine Province, on the right bank of the Rhine, opposite to Cologne, with which it has been incorporated since 1888. It contains the church of St Heribert, built in the 17th century, cavalry barracks, artillery magazines, and gas, porcelain, machine and carriage factories. It has a handsome railway station on the banks of the Rhine, negotiating the local traffic with Elberfeld and Königswinter. The fortifications of the town form part of the defences of Cologne. To the east is the manufacturing suburb of Kalk.

The old castle in Deutz was in 1002 made a Benedictine monastery by Heribert, archbishop of Cologne. Permission to fortify the town was in 1230 granted to the citizens by the archbishop of Cologne, between whom and the counts of Berg it was in 1240 divided. It was burnt in 1376, 1483 and 1583; and in 1678, after the peace of Nijmwegen, the fortifications were dismantled; rebuilt in 1816, they were again razed in 1891.

DEUX-SÈVRES, an inland department of western France, formed in 1790 mainly of the three districts of Poitou, Thouarsais, Gâtine and Niortais, added to a small portion of Saintonge and a still smaller portion of Aunis. Area, 2337 sq. m. Pop. (1906) 339,466. It is bounded N. by Maine-et-Loire, E. by Vienne, S.E. by Charente, S. by Charente-Inférieure and W. by Vendée. The department takes its name from two rivers—the Sèvre of Niort which traverses the southern portion, and the Sèvre of Nantes (an affluent of the Loire) which drains the north-west. There are three regions—the Gâtine, occupying the north and centre of the department, the Plaine in the south and the Marais,—distinguished by their geological character and their general physical appearance. The Gâtine, formed of primitive rocks (granite and schists), is the continuation of the "Bocage" of Vendée and Maine-et-Loire. Its surface is irregular and covered with hedges and clumps of wood or forests. The systematic application of lime has much improved the soil, which is naturally poor. The Plaine, resting on oolite limestone, is treeless but fertile. The Marais, a low-lying district in the extreme south-west, consists of alluvial clays which also are extremely productive when properly drained. The highest points, several of which exceed 700 ft., are found in a line of hills which begins in the centre of the department, to the south of Parthenay, and stretches north-west into the neighbouring department of Vendée. It divides the region drained by the Sèvre Nantaise and the Thouet (both affluents of the Loire) in the north from the basins of the Sèvre Niortaise and the Charente in the south. The climate is mild, the annual temperature at Niort being 54° Fahr., and the rainfall nearly 25 in. The winters are colder in the Gâtine, the summers warmer in the Plaine.

Three-quarters of the entire area of Deux-Sèvres, which is primarily an agricultural department, consists of arable land. Wheat and oats are the main cereals. Potatoes and mangold-wurzels are the chief root-crops. Niort is a centre for the growing of vegetables (onions, asparagus, artichokes, &c.) and of angelica. Considerable quantities of beetroot are raised to supply the distilleries of Melle. Colza, hemp, rape and flax are also cultivated. Vineyards are numerous in the neighbourhood of Bressuire in the north, and of Niort and Melle in the south. The department is well known for the Parthenay breed of cattle and the Poitou breed of horses; and the mules reared in the southern arrondissements are much sought after both in France and in Spain. The system of co-operative dairying is practised in some localities. The apple-trees of the Gâtine and the walnut-trees of the Plaine bring a good return. Coal is mined, and the department produces building-stone and lime. A leading industry is the manufacture of textiles (serges, druggets, linen, handkerchiefs, flannels, swan-skins and knitted goods). Tanning and leather-dressing are carried on at Niort and other places, and gloves are made at Niort. Wool and cotton spinning, hat and shoe making, distilling, brewing, flour-milling and oil-refining are also main industries. The department exports cattle and sheep to Paris and Poitiers; also cereals, oils, wines, vegetables and its industrial products.

The Sèvre Niortaise and its tributary the Mignon furnish 19 m. of navigable waterway. The department is served by the Ouest-État railway. It contains a large proportion of Protestants, especially in the south-east. The four arrondissements are Niort, Bressuire, Melle and Parthenay; the cantons number 31, and the communes 356. Deux-Sèvres is part of the region of the IX. army corps, and of the diocese and the académie (educational circumscription) of Poitiers, where also is its court of appeal.

Niort (the capital), Bressuire, Melle, Parthenay, St Maixent, Thouars and Oiron are the principal places in the department. Several other towns contain features of interest. Among these

are Airvault, where there is a church of the 12th and 14th centuries which once belonged to the abbey of St Pierre, and an ancient bridge built by the monks; Celles-sur-Belle, where there is an old church rebuilt by Louis XI., and again in the 17th century; and St Jouin-de-Marnes, with a fine Romanesque church with Gothic restoration, which belonged to one of the most ancient abbeys of Gaul.

DEVA (Sanskrit "heavenly"), in Hindu and Buddhist mythology, spirits of the light and air, and minor deities generally beneficent. In Persian mythology, however, the word is used for evil spirits or demons. According to Zoroaster the devas were created by Ahriman.

DEVA (mod. *Chester*), a Roman legionary fortress in Britain on the Dee. It was occupied by Roman troops about A.D. 48 and held probably till the end of the Roman dominion. Its garrison was the Legio XX. Valeria Victrix, with which another legion (II. Adjutrix) was associated for a few years, about A.D. 75–85. It never developed, like many Roman legionary fortresses, into a town, but remained military throughout. Parts of its north and east walls (from Morgan's Mount to Peppergate) and numerous inscriptions remain to indicate its character and area.

See F. J. Haverfield, *Catalogue of the Grosvenor Museum, Chester* (Chester, 1900), Introduction.

DEVADATTA, the son of Suklodana, who was younger brother to the father of the Buddha (*Mahāvastu*, iii. 76). Both he and his brother Ānanda, who were considerably younger than the Buddha, joined the brotherhood in the twentieth year of the Buddha's ministry. Four other cousins of theirs, chiefs of the Sākiya clan, and a barber named Upāli, were admitted to the order at the same time; and at their own request the barber was admitted first, so that as their senior in the order he should take precedence of them (*Vinaya Texts*, iii. 228). All the others continued loyal disciples, but Devadatta, fifteen years afterwards, having gained over the crown prince of Magadha, Ajātasattu, to his side, made a formal proposition, at the meeting of the order, that the Buddha should retire, and hand over the leadership to him, Devadatta (*Vinaya Texts*, iii. 238; *Jātaka*, i. 142). This proposal was rejected, and Devadatta is said in the tradition to have successfully instigated the prince to the execution of his aged father and to have made three abortive attempts to bring about the death of the Buddha (*Vinaya Texts*, ii. 241-250; *Jātaka*, vi. 131). Shortly afterwards, relying upon the feeling of the people in favour of asceticism, he brought forward four propositions for ascetic rules to be imposed on the order. These being refused, he appealed to the people, started an order of his own, and gained over 500 of the Buddha's community to join in the secession. We hear nothing further about the success or otherwise of the new order, but it may possibly be referred to under the name of the Gotamakas, in the *Anguttara* (see *Dialogues of the Buddha*, i. 222), for Devadatta's family name was Gotama. But his community was certainly still in existence in the 4th century A.D., for it is especially mentioned by Fa Hien, the Chinese pilgrim (Legge's translation, p. 62). And it possibly lasted till the 7th century, for Hsüan Tsang mentions that in a monastery in Bengal the monks then followed a certain regulation of Devadatta's (T. Watters, *On Yuan Chwang*, ii. 191). There is no mention in the canon as to how or when Devadatta died; but the commentary on the *Jātaka*, written in the 5th century A.D., has preserved a tradition that he was swallowed up by the earth near Sāvatthi, when on his way to ask pardon of the Buddha (*Jātaka*, iv. 158). The spot where this occurred was shown to both the pilgrims just mentioned (Fa Hien, *loc. cit.* p. 60; and T. Watters, *On Yuan Chwang*, i. 390). It is a striking example of the way in which such legends grow, that it is only the latest of these authorities, Hsüan Tsang, who says that, though ostensibly approaching the Buddha with a view to reconciliation, Devadatta had concealed poison in his nail with the object of murdering the Buddha.

AUTHORITIES.—*Vinaya Texts*, translated by Rhys Davids and H. Oldenberg (3 vols., Oxford, 1881–1885); *The Jātaka*, edited by V. Fausböll (7 vols., London, 1877–1897); T. Watters, *On Yuan Chwang* (ed. Rhys Davids and Bushell, 2 vols., London, 1904–1905); *Fa Hian*, translated by J. Legge (Oxford, 1886); *Mahāvastu* (ed. Senart, 3 vols., Paris, 1882–1897). (T. W. R. D.)

DEVAPRAYAG (DEOPRAYAG), a village in Tehri State of the United Provinces, India. It is situated at the spot where the rivers Alaknanda and Bhagirathi unite and form the Ganges, and as one of the five sacred confluences in the hills is a great place of pilgrimage for devout Hindus. Devaprayag stands at an elevation of 2265 ft. on the side of a hill which rises above it 800 ft. On a terrace in the upper part of the village is the temple of Raghunath, built of huge uncemented stones, pyramidical in form and capped by a white cupola.

DEVENS, CHARLES (1820–1891), American lawyer and jurist, was born in Charlestown, Massachusetts, on the 4th of April 1820. He graduated at Harvard College in 1838, and at the Harvard law school in 1840, and was admitted to the bar in Franklin county, Mass., where he practised from 1841 to 1849. In the year 1848 he was a Whig member of the state senate, and from 1849 to 1853 was United States marshal for Massachusetts, in which capacity he was called upon in 1851 to remand the fugitive slave, Thomas Sims, to slavery. This he felt constrained to do, much against his personal desire; and subsequently he attempted in vain to purchase Sims's freedom, and many years later appointed him to a position in the department of justice at Washington. Devens practised law at Worcester from 1853 until 1861, and throughout the Civil War served in the Federal army, becoming colonel of volunteers in July 1861 and brigadier-general of volunteers in April 1862. At the battle of Ball's Bluff (1861) he was severely wounded; he was again wounded at Fair Oaks (1862) and at Chancellorsville (1863), where he commanded a division. He later distinguished himself at Cold Harbor, and commanded a division in Grant's final campaign in Virginia (1864–65), his troops being the first to occupy Richmond after its fall. Breveted major-general in 1865, he remained in the army for a year as commander of the military district of Charleston, South Carolina. He was a judge of the Massachusetts superior court from 1867 to 1873, and was an associate justice of the supreme court of the state from 1873 to 1877, and again from 1881 to 1891. From 1877 to 1881 he was attorney-general of the United States in the cabinet of President Hayes. He died at Boston, Mass., on the 7th of January 1891.

See his *Orations and Addresses*, with a memoir by John Codman Ropes (Boston, 1891).

DEVENTER, a town in the province of Overysel, Holland, on the right bank of the Ysel, at the confluence of the Schipbeek, and a junction station 10 m. N. of Zutphen by rail. It is also connected by steam tramway S.E. with Brokulo. Pop. (1900) 26,212. Deventer is a neat and prosperous town situated in the midst of prettily wooded environs, and containing many curious old buildings. There are three churches of special interest: the Groote Kerk (St Lebuinus), which dates from 1334, and occupies the site of an older structure of which the 11th-century crypt remains; the Roman Catholic Broederkerk, or Brothers' Church, containing among its relics three ancient gospels said to have been written by St Lebuinus (Lebwin), the English apostle of the Frisians and Westphalians (d. *c.* 773); and the Bergkerk, dedicated in 1206, which has two late Romanesque towers. The town hall (1693) contains a remarkable painting of the town council by Terburg. In the fine square called the Brink is the old weigh-house, now a school (gymnasium), built in 1528, with a large external staircase (1644). The gymnasium is descended from the Latin school of which the celebrated Alexander Hegius was master in the third quarter of the 15th century, when the young Erasmus was sent to it, and at which Adrian Floreizoon, afterwards Pope Adrian VI., is said to have been a pupil about the same time. Another famous educational institution was the "Athenaeum" or high school, founded in 1630, at which Henri Renery (d. 1639) taught philosophy, while Johann Friedrich Gronov (Gronovius) (1611–1671) taught rhetoric and history in the middle of the same century. The "Athenaeum" disappeared in 1876. In modern times Deventer possessed a famous teacher in Dr Burgersdyk (d. 1900), the Dutch translator of Shakespeare. The town library, also called the library of the

Athenaeum, includes many MSS. and *incunabula*, and a 13th-century copy of *Reynard the Fox*. The archives of the town are of considerable value. Besides a considerable agricultural trade, Deventer has important iron foundries and carpet factories (the royal manufactory of Smyrna carpets being especially famous); while cotton-printing, rope-making and the weaving of woollens and silks are also carried on. A public official is appointed to supervise the proper making of a form of gingerbread known as "*Deventer Koek*," which has a reputation throughout Holland. In the church of Bathmen, a village 5 m. E. of Deventer, some 14th-century frescoes were discovered in 1870.

In the 14th century Deventer was the centre of the famous religious and educational movement associated with the name of Gerhard Groot (*q.v.*), who was a native of the town (see BROTHERS OF COMMON LIFE).

DE VERE, AUBREY THOMAS (1814–1902), Irish poet and critic, was born at Curragh Chase, Co. Limerick, on the 10th of January 1814, being the third son of Sir Aubrey de Vere Hunt (1788–1846). In 1832 his father dropped the final name by royal licence. Sir Aubrey was himself a poet. Wordsworth called his sonnets the "most perfect of the age." These and his drama, *Mary Tudor*, were published by his son in 1875 and 1884. Aubrey de Vere was educated at Trinity College, Dublin, and in his twenty-eighth year published *The Waldenses*, which he followed up in the next year by *The Search after Proserpine*. Thenceforward he was continually engaged, till his death on the 20th of January 1902, in the production of poetry and criticism. His best-known works are: in verse, *The Sisters* (1861); *The Infant Bridal* (1864); *Irish Odes* (1869); *Legends of St Patrick* (1872); and *Legends of the Saxon Saints* (1879); and in prose, *Essays chiefly on Poetry* (1887); and *Essays chiefly Literary and Ethical* (1889). He also wrote a picturesque volume of travel-sketches, and two dramas in verse, *Alexander the Great* (1874); and *St Thomas of Canterbury* (1876); both of which, though they contain fine passages, suffer from diffuseness and a lack of dramatic spirit. The characteristics of Aubrey de Vere's poetry are "high seriousness" and a fine religious enthusiasm. His research in questions of faith led him to the Roman Church; and in many of his poems, notably in the volume of sonnets called *St Peter's Chains* (1888), he made rich additions to devotional verse. He was a disciple of Wordsworth, whose calm meditative serenity he often echoed with great felicity; and his affection for Greek poetry, truly felt and understood, gave dignity and weight to his own versions of mythological idylls. But perhaps he will be chiefly remembered for the impulse which he gave to the study of Celtic legend and literature. In this direction he has had many followers, who have sometimes assumed the appearance of pioneers; but after Matthew Arnold's fine lecture on "Celtic Literature," nothing perhaps did more to help the Celtic revival than Aubrey de Vere's tender insight into the Irish character, and his stirring reproductions of the early Irish epic poetry.

A volume of *Selections* from his poems was edited in 1894 (New York and London) by G. E. Woodberry.

DEVICE, a scheme, plan, simple mechanical contrivance; also a pattern or design, particularly an heraldic design or emblem, often combined with a motto or legend. "Device" and its doublet "devise" come from the two Old French forms *devis* and *devise* of the Latin *divisa*, things divided, from *dividere*, to separate, used in the sense of to arrange, set out, apportion. "Devise," as a substantive, is now only used as a legal term for a disposition of property by will, by a modern convention restricted to a disposition of real property, the term "bequest" being used of personalty (see WILL). This use is directly due to the Medieval Latin meaning of *dividere=testamento disponere*. In its verbal form, "devise" is used not only in the legal sense, but also in the sense of to plan, arrange, scheme.

DEVIL (Gr. διάβολος, "slanderer," from διαβάλλειν, to slander), the generic name for a spirit of evil, especially the supreme spirit of evil, the foe of God and man. The word is used for minor evil spirits in much the same sense as "demon." From the various characteristics associated with this idea, the term has come to be applied by analogy in many different senses. From the idea of evil as degraded, contemptible and doomed to failure, the term is applied to persons in evil plight, or of slight consideration. In English legal phraseology "devil" and "devilling" are used of barristers who act as substitutes for others. Any remuneration which the legal "devil" may receive is purely a matter of private arrangement between them. In the chancery division such remuneration is generally in the proportion of one half of the fee which the client pays; "in the king's bench division remuneration for 'devilling' of briefs or assisting in drafting and opinions is not common" (see *Annual Practice*, 1907, p. 717). In a similar sense an author may have his materials collected and arranged by a literary hack or "devil." The term "printer's devil" for the errand boy in a printing office probably combines this idea with that of his being black with ink. The common notions of the devil as black, ill-favoured, malicious, destructive and the like, have occasioned the application of the term to certain animals (the Tasmanian devil, the devil-fish, the coot), to mechanical contrivances (for tearing up cloth or separating wool), to pungent, highly seasoned dishes, broiled or fried. In this article we are concerned with the primary sense of the word, as used in mythology and religion.

The primitive philosophy of animism involves the ascription of all phenomena to personal agencies. As phenomena are good or evil, produce pleasure or pain, cause weal or woe, a distinction in the character of these agencies is gradually recognized; the agents of good become gods, those of evil, demons. A tendency towards the simplification and organization of the evil as of the good forces, leads towards belief in outstanding leaders among the forces of evil. When the divine is most completely conceived as unity, the demonic is also so conceived; and over against God stands Satan, or the devil.

Although it is in connexion with Hebrew and Christian monotheism that this belief in the devil has been most fully developed, yet there are approaches to the doctrine in other religions. In Babylonian mythology "the old serpent goddess 'the lady Nina' was transformed into the embodiment of all that was hostile to the powers of heaven" (Sayce's *Hibbert Lectures*, p. 283), and was confounded with the dragon Tiamat, "a terrible monster, reappearing in the Old Testament writings as Rahab and Leviathan, the principle of chaos, the enemy of God and man" (Tennant's *The Fall and Original Sin*, p. 43), and according to Gunkel (*Schöpfung und Chaos*, p. 383) "the original of the 'old serpent' of Rev. xii. 9." In Egyptian mythology the serpent Apap with an army of monsters strives daily to arrest the course of the boat of the luminous gods. While the Greek mythology described the Titans as "enchained once for all in their dark dungeons" yet Prometheus' threat remained to disturb the tranquillity of the Olympian Zeus. In the German mythology the army of darkness is led by Hel, the personification of twilight, sunk to the goddess who enchains the dead and terrifies the living, and Loki, originally the god of fire, but afterwards "looked upon as the father of the evil powers, who strips the goddess of earth of her adornments, who robs Thor of his fertilizing hammer, and causes the death of Balder the beneficent sun." In Hindu mythology the Maruts, Indra, Agni and Vishnu wage war with the serpent Ahi to deliver the celestial cows or spouses, the waters held captive in the caverns of the clouds. In the *Trimurti*, Brahmā (the impersonal) is manifested as Brahmā (the personal creator), Vishnu (the preserver), and Siva (the destroyer). In Siva is perpetuated the belief in the god of Vedic times Rudra, who is represented as "the wild hunter who storms over the earth with his bands, and lays low with arrows the men who displease him" (Chantepie de la Saussaye's *Religionsgeschichte*, 2nd ed., vol. ii. p. 25). The evil character of Siva is reflected in his wife, who as Kali (the black) is the wild and cruel goddess of destruction and death. The opposition of good and evil is most fully carried out in Zoroastrianism. Opposed to Ormuzd, the author of all good, is Ahriman, the source of all evil; and the opposition runs through the whole universe (D'Alviella's *Hibbert Lectures*, pp. 158-164).

The conception of *Satan* (Heb. שָׂטָן, the adversary, Gr. Σατανᾶς, or Σατᾶν, 2 Cor. xii. 7) belongs to the post-exilic period of Hebrew development, and probably shows traces of the

influence of Persian on Jewish thought, but it has also its roots in much older beliefs. An "evil spirit" possesses Saul (1 Sam. xvi. 14), but it is "from the Lord." The same agency produces discord between Abimelech and the Shechemites (Judges ix. 23). "A lying spirit in the mouth of all his prophets" as Yahweh's messenger entices Ahab to his doom (1 Kings xxii. 22). Growing human corruption is traced to the fleshy union of angels and women (Gen. vi. 1-4). But generally evil, whether as misfortune or as sin, is assigned to divine causality (1 Sam. xviii. 10; 2 Sam. xxiv. 1; 1 Kings xxii. 20; Isa. vi. 10, lxiii. 17). After the Exile there is a tendency to protect the divine transcendence by the introduction of mediating angelic agency, and to separate all evil from God by ascribing its origin to Satan, the enemy of God and man. In the prophecy of Zechariah (iii. 1-2) he stands as the adversary of Joshua, the high priest, and is rebuked by Yahweh for desiring that Jerusalem should be further punished. In the book of Job he presents himself before the Lord among the sons of God (ii. 1), yet he is represented both as accuser and tempter. He disbelieves in Job's integrity, and desires him to be so tried that he may fall into sin. While, according to 2 Sam. xxiv. 1, God himself tests David in regard to the numbering of the people, according to 1 Chron. xxi. 1 it is Satan who tempts him.

The development of the conception continued in later Judaism, which was probably more strongly influenced by Persian dualism. It is doubtful, however, whether the Asmodeus (*q.v.*) of the book of Tobit is the same as the Ashma Daēwa of the Bundahesh. He is the evil spirit who slew the seven husbands of Sara (iii. 8), and the name probably means 'Destroyer.' In the book of Enoch Satan is represented as the ruler of a rival kingdom of evil, but here are also mentioned Satans, who are distinguished from the fallen angels and who have a threefold function, to tempt, to accuse and to punish. Satan possesses the ungodly (Ecclesiasticus xxi. 27), is identified with the serpent of Gen. iii. (Wisdom ii. 24), and is probably also represented by Asmodeus, to whom lustful qualities are assigned (Tobit vi. 14); Gen. iii. is probably referred to in Psalms of Solomon xvii. 40, "a serpent speaking with the words of transgressors, words of deceit to pervert wisdom." The *Book of the Secrets of Enoch* not only identifies Satan with the Serpent, but also describes his revolt against God, and expulsion from heaven. In the Jewish *Targums* Sammael, "the highest angel that stands before God's throne, caused the serpent to seduce the woman"; he coalesces with Satan, and has inferior Satans as his servants. The birth of Cain is ascribed to a union of Satan with Eve. As accuser affecting man's standing before God he is greatly feared.

This doctrine, stripped of much of its grossness, is reproduced in the New Testament. Satan is the διάβολος (Matt. xiii. 39; John xiii. 2; Eph. iv. 27; Heb. ii. 14; Rev. ii. 10), slanderer or accuser, the πειράζων (Matt. iv. 3; 1 Thess. iii. 5), the tempter, the πονηρός (Matt. v. 37; John xvii. 15; Eph. vi. 16), the evil one, and the ἐχθρός (Matt. xiii. 39), the enemy. He is apparently identified with Beelzebub (or Beelzebul) in Matt. xii. 26, 27. Jesus appears to recognize the existence of demons belonging to a kingdom of evil under the leadership of Satan "the prince of demons" (Matt. xii. 24, 26, 27), whose works in demonic possessions it is his function to destroy (Mark i. 34, iii. 11, vi. 7; Luke x. 17-20). But he himself conquers Satan in resisting his temptations (Matt. iv. 1-11). Simon is warned against him, and Judas yields to him as tempter (Luke xxii. 31; John xiii. 27). Jesus's cures are represented as a triumph over Satan (Luke x. 18). This Jewish doctrine is found in Paul's letters also. Satan rules over a world of evil, supernatural agencies, whose dwelling is in the lower heavens (Eph. vi. 12): hence he is the "prince of the power of the air" (ii. 2). He is the tempter (1 Thess. iii. 5; 1 Cor. vii. 5), the destroyer (x. 10), to whom the offender is to be handed over for bodily destruction (v. 5), identified with the serpent (Rom. xvi. 20; 2 Cor. xi. 3), and probably with Beliar or Belial (vi. 15); and the surrender of man to him brought death into the world (Rom. v. 17). Paul's own "stake in the flesh" is Satan's messenger (2 Cor. xii. 7). According to Hebrews Satan's power over death Jesus destroys by dying (ii. 14). Revelation describes the war in heaven between God with his angels and Satan or the dragon, the "old serpent," the deceiver of the whole world (xii. 9), with his hosts of darkness. After the overthrow of the Beast and the kings of the earth, Satan is imprisoned in the bottomless pit a thousand years (xx. 2). Again loosed to deceive the nations, he is finally cast into the lake of fire and brimstone (xx. 10; cf. Enoch liv. 5, 6; 2 Peter ii. 4). In John's Gospel and Epistles Satan is opposed to Christ. Sinner and murderer from the beginning (1 John iii. 8) and liar by nature (John viii. 44), he enslaves men to sin (viii. 34), causes death (verse 44), rules the present world (xiv. 30), but has no power over Christ or those who are his (xiv. 30, xvi. 11; 1 John v. 18). He will be destroyed by Christ with all his works (John xvi. 33; 1 John iii. 8).

In the common faith of the Gentile churches after the Apostolic Age "the present dominion of evil demons, or of one evil demon, was just as generally presupposed as man's need of redemption, which was regarded as a result of that dominion. The tenacity of this belief may be explained among other things by the living impression of the polytheism that surrounded the communities on every side. By means of this assumption too, humanity seemed to be unburdened, and the presupposed capacity for redemption could, therefore, be justified in its widest range" (Harnack's *History of Dogma*, i. p. 181). While Christ's First Advent delivered believers from Satan's bondage, his overthrow would be completed only by the Second Advent. The Gnostics held that "the present world sprang from a fall of man, or from an undertaking hostile to God, and is, therefore, the product of an evil or intermediate being" (p. 257). Some taught that while the future had been assigned by God to Christ, the devil had received the present age (p. 309). The fathers traced all doctrines not held by the Catholic Church to the devil, and the virtues of heretics were regarded as an instance of the devil transforming himself into an angel of light (ii. 91). Irenaeus ascribes Satan's fall to "pride and arrogance and envy of God's creation"; and traces man's deliverance from Satan to Christ's victory in resisting his temptations; but also, guided by certain Pauline passages, represents the death of Christ "as a ransom paid to the 'apostasy' for men who had fallen into captivity" (ii. 290). He does not admit that Satan has any lawful claim on man, or that God practised a deceit on him, as later fathers taught. This theory of the *atonement* was formulated by Origen. "By his successful temptation the devil acquired a right over men. God offered Christ's soul for that of men. But the devil was duped, as Christ overcame both him and death" (p. 367). It was held by Gregory of Nyssa, Ambrose, who uses the phrase *pia fraus*, Augustine, Leo I., and Gregory I., who expresses it in its worst form. "The humanity of Christ was the bait; the fish, the devil, snapped at it, and was left hanging on the invisible hook, Christ's divinity" (iii. 307). In Athanasius the relation of the work of Christ to Satan retires into the background, Gregory of Nazianzus and John of Damascus felt scruples about this view. It is expressly repudiated by Anselm and Abelard. Peter the Lombard asserted it, disregarding these objections. Bernard represents man's bondage to Satan "as righteously permitted as a just retribution for sin," he being "the executioner of the divine justice." Another theory of Origen's found less acceptance. The devil, as a being resulting from God's will, cannot always remain a devil. The possibility of his redemption, however, was in the 5th century branded as a heresy. Persian dualism was brought into contact with Christian thought in the doctrine of Mani; and it is permissible to believe that the gloomy views of Augustine regarding man's condition are due in some measure to this influence. Mani taught that Satan with his demons, sprung from the kingdom of darkness, attacked the realm of light, the earth, defeated man sent against him by the God of light, but was overthrown by the God of light, who then delivered the primeval man (iii. 324). "During the middle ages," says Tulloch, "the belief in the devil was absorbing—saints conceived themselves and others to be in constant conflict with him." This superstition, perhaps at its strongest in the 13th to the 15th century, passed into Protestantism. Luther

was always conscious of the presence and opposition of Satan. "As I found he was about to begin again," says Luther, "I gathered together my books, and got into bed. Another time in the night I heard him above my cell walking in the cloister, but as I knew it was the devil I paid no attention to him and went to sleep." He held that this world will pass away with its pleasures, as there can be no real improvement in it, for the devil continues in it to ply his daring and seductive devices (vii. 191). I. A. Dorner (*Christian Doctrine*, iii. p. 93) sums up Protestant doctrine as follows:—"He is brought into relation with natural sinfulness, and the impulse to evil thoughts and deeds is ascribed to him. The dominion of evil over men is also represented as a slavery to Satan, and this as punishment. He has his full power in the extra-Christian world. But his power is broken by Christ, and by his word victory over him is to be won. The power of creating anything is also denied the devil, and only the power of corrupting substances is conceded to him. But it is only at the Last Judgment that his power is wholly annihilated; he is himself delivered up to eternal punishment." This belief in the devil was specially strong in Scotland among both clergy and laity in the 17th century. "The devil was always and literally at hand," says Buckle, "he was haunting them, speaking to them, and tempting them. Go where they would he was there."

In more recent times a great variety of opinions has been expressed on this subject. J. S. Semler denied the reality of demonic possession, and held that Christ in his language accommodated himself to the views of the sick whom he was seeking to cure. Kant regarded the devil as a personification of the radical evil in man. Daub in his *Judas Ishcarioth* argued that a finite evil presupposes an absolute evil, and the absolute evil as real must be in a person. Schelling regarded the devil as, not a person, but a real principle, a spirit let loose by the freedom of man. Schleiermacher was an uncompromising opponent of the common belief. "The problem remains to seek evil rather in self than in Satan, Satan only showing the limits of our self-knowledge." Dorner has formulated a theory which explains the development of the conception of Satan in the Holy Scriptures as in correspondence with an evolution in the character of Satan. "Satan appears in Scripture under four leading characters:—first as the tempter of freedom, who desires to bring to decision, secondly as the accuser, who by virtue of the law retorts criminality on man; thirdly as the instrument of the Divine, which brings evil and death upon men; fourthly and lastly he is described, especially in the New Testament, as the enemy of God and man." He supposes "a change in Satan in the course of the history of the divine revelation, in conflict with which he came step by step to be a sworn enemy of God and man, especially in the New Testament times, in which, on the other hand, his power is broken at the root by Christ." He argues that "the world-order, being in process as a moral order, permits breaches everywhere into which Satan can obtain entrance" (pp. 99, 102). H. L. Martensen gives even freer rein to speculation. "The evil principle," he says, "has in itself no personality, but attains a progressively universal personality in its kingdom; it has no individual personality, save only in individual creatures, who in an especial manner make themselves its organs; but among these is one creature in whom the principle is so hypostasized that he has become the centre and head of the kingdom of evil" (*Dogmatics*, p. 199). A. Ritschl gives no place in his constructive doctrine to the belief in the devil; but recognizes that the mutual action of individual sinners on one another constitutes a kingdom of sin, opposed to the Kingdom of God (A. E. Garvie, *The Ritschlian Theology*, p. 304). Kaftan affirms that a "doctrine about Satan can as little be established as about angels, as faith can say nothing about it, and nothing is gained by it for the dogmatic explanation of evil. This whole province must be left to the immediate world-view of the pious. The idea of Satan will on account of the Scriptures not disappear from it, and it would be arrogant to wish to set it aside. Only let everyone keep the thought that Satan also stands under the commission of the Almighty God, and that no one must suppose that by leading back his sins to a Satanic temptation he can get rid of his own guilt. To transgress these limits is to assail faith" (*Dogmatik*, p. 348). In the book entitled *Evil and Evolution* there is "an attempt to turn the light of modern science on to the ancient mystery of evil." The author contends that the existence of evil is best explained by assuming that God is confronted with Satan, who in the process of evolution interferes with the divine designs, an interference which the instability of such an evolving process makes not incredible. Satan is, however, held to be a creature who has by abuse of his freedom been estranged from, and opposed to his Creator, and who at last will be conquered by moral means. W. M. Alexander in his book on demonic possession maintains that "the confession of Jesus as the Messiah or Son of God is the classical criterion of genuine demonic possession" (p. 150), and argues that as "the Incarnation indicated the establishment of the kingdom of heaven upon earth," there took place "a counter movement among the powers of darkness," of which "genuine demonic possession was one of the manifestations" (p. 249).

Interesting as these speculations are, it may be confidently affirmed that belief in Satan is not now generally regarded as an essential article of the Christian faith, nor is it found to be an indispensable element of Christian experience. On the one hand science has so explained many of the processes of outer nature and of the inner life of man as to leave no room for Satanic agency. On the other hand the modern view of the inspiration of the Scriptures does not necessitate the acceptance of the doctrine of the Scriptures on this subject as finally and absolutely authoritative. The teaching of Jesus even in this matter may be accounted for as either an accommodation to the views of those with whom he was dealing or more probably as a proof of the limitation of knowledge which was a necessary condition of the Incarnation, for it cannot be contended that as revealer of God and redeemer of men it was imperative that he should either correct or confirm men's beliefs in this respect. The possibility of the existence of evil spirits, organized under one leader Satan to tempt man and oppose God, cannot be denied; the sufficiency of the evidence for such evil agency may, however, be doubted; the necessity of any such belief for Christian thought and life cannot, therefore, be affirmed. (See also DEMONOLOGY; POSSESSION.) (A. E. G.*)

DEVIZES a market town and municipal borough in the Devizes parliamentary division of Wiltshire, England, 86 m. W. by S. of London by the Great Western railway. Pop. (1901) 6532. Its castle was built on a tongue of land flanked by two deep ravines, and behind this the town grew up in a semicircle on a stretch of bare and exposed tableland. Its main streets, in which a few ancient timbered houses are left, radiate from the market place, where stands a Gothic cross, the gift of Lord Sidmouth in 1814. The Kennet and Avon Canal skirts the town on the N., passing over the high ground through a chain of thirty-nine locks. St John's church, one of the most interesting in Wiltshire, is cruciform, with a massive central tower, based upon two round and two pointed arches. It was originally Norman of the 12th century, and the chancel arch and low vaulted chancel, in this style, are very fine. In the interior several ancient monuments of the Suttons and Heathcotes are preserved, besides some beautiful carved stone work, and two rich ceilings of oak over the chapels. St Mary's, a smaller church, is partly Norman, but was rebuilt in the 15th and again in the 19th century. Its lofty clerestoried nave has an elaborately carved timber roof, and the south porch, though repaired in 1612, preserves its Norman mouldings. The woollen industries of Devizes have lost their prosperity; but there is a large grain trade, with engineering works, breweries, and manufactures of silk, snuff, tobacco and agricultural implements. The town is governed by a mayor, six aldermen and eighteen councillors. Area, 906 acres.

Devizes (*Divisis*, *la Devise*, *De Vies*) does not appear in any historical document prior to the reign of Henry I., when the construction of a castle of exceptional magnificence by Roger, bishop of Salisbury, at once constituted the town an important political centre, and led to its speedy development. After the

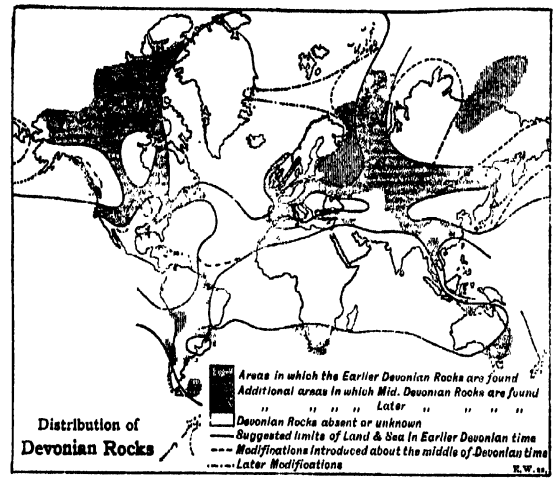
disgrace of Roger in 1139 the castle was seized by the Crown; in the 14th century it formed part of the dowry of the queens of England, and figured prominently in history until its capture and demolition by Cromwell in the Civil War of the 17th century. Devizes became a borough by prescription, and the first charter from Matilda, confirmed by successive later sovereigns, merely grants exemption from certain tolls and the enjoyment of undisturbed peace. Edward III. added a clause conferring on the town the liberties of Marlborough, and Richard II. instituted a coroner. A gild merchant was granted by Edward I., Edward II. and Edward III., and in 1614 was divided into the three companies of drapers, mercers and leathersellers. The present governing charters were issued by James I. and Charles I., the latter being little more than a confirmation of the former, which instituted a common council consisting of a mayor, a town clerk and thirty-six capital burgesses. These charters were surrendered to Charles II., and a new one was conferred by James II., but abandoned three years later in favour of the original grant. Devizes returned two members to parliament from 1295, until deprived of one member by the Representation of the People Act of 1867, and of the other by the Redistribution Act of 1885. The woollen manufacture was the staple industry of the town from the reign of Edward III. until the middle of the 18th century, when complaints as to the decay of trade began to be prevalent. In the reign of Elizabeth the market was held on Monday, and there were two annual fairs at the feasts of the Purification of the Virgin and the Decollation of John the Baptist. The market was transferred to Thursday in the next reign, and the fairs in the 18th century had become seven in number.

See *Victoria County History, Wiltshire; History of Devizes* (Devizes, 1859).

DEVOLUTION, WAR OF (1667–68), the name applied to the war which arose out of Louis XV.'s claims to certain Spanish territories in right of his wife Maria Theresa, upon whom the ownership was alleged to have "devolved." (See, for the military operations, DUTCH WARS.) The war was ended by the treaty of Aix-la-Chapelle in 1668.

DEVON, EARLS OF. From the family of De Redvers (De Ripuariis; Riviers), who had been earls of Devon from about 1100, this title passed to Hugh de Courtenay (*c.* 1275–1340), the representative of a prominent family in the county (see Gibbon's "digression" in chap. lxi. of the *Decline and Fall*, ed. Bury), but was subsequently forfeited by Thomas Courtenay (1432–1462), a Lancastrian who was beheaded after the battle of Towton. It was revived in 1485 in favour of Edward Courtenay (d. 1509), whose son Sir William (d. 1511) married Catherine, daughter of Edward IV. Too great proximity to the throne led to his attainder, but his son Henry (*c.* 1498–1539) was restored in blood in 1517 as earl of Devon, and in 1525 was created marquess of Exeter; his second wife was a daughter of William Blount, 4th Lord Mountjoy. The title again suffered forfeiture on Henry's execution, but in 1553 it was recreated for his son Edward (1526–1556). At the latter's death it became dormant in the Courtenay family, till in 1831 a claim by a collateral branch was allowed by the House of Lords, and the earldom of Devon was restored to the peerage, still being held by the head of the Courtenays. The earlier earls of Devon were referred to occasionally as earls of Devonshire, but the former variant has prevailed, and the latter is now solely used for the earldom and dukedom held by the Cavendishes (see DEVONSHIRE, EARLS AND DUKES OF, and also the article COURTENAY).

DEVONIAN SYSTEM, in geology, the name applied to series of stratified fossiliferous and igneous rocks that were formed during the Devonian period, that is, in the interval of time between the close of the Silurian period and the beginning of the Carboniferous; it includes the marine Devonian and an estuarine Old Red Sandstone series of strata. The name "Devonian" was introduced in 1829 by Sir R. Murchison and A. Sedgwick to describe the older rocks of Cornwall and Devon which W. Lonsdale had shown, from an examination of the fossils, to be intermediate between the Silurian and Carboniferous. The same two workers also carried on further researches upon the same rocks of the European continent, where already several others, F. Roemer, H. E. Beyrich, &c., were endeavouring to elucidate the succession of strata in this portion of the "Transition Series." The labours of these earlier workers, including in addition to those already mentioned, the brothers F. and G. von Sandberger, A. Dumont, J. Gosselet, E. J. A. d'Archiac, E. P. de Verneuil and H. von



Dechen, although somewhat modified by later students, formed the foundation upon which the modern classification of the Devonian rocks is based.

Stratigraphy of the Devonian Facies.

Notwithstanding the fact that it was in Devonshire and Cornwall that the Devonian rocks were first distinguished, it is in central Europe that the succession of strata is most clearly made out, and here, too, their geological position was first indicated by the founders of the system, Sedgwick and Murchison.

Continental Europe.—Devonian rocks occupy a large area in the centre of Europe, extending from the Ardennes through the south of Belgium across Rhenish Prussia to Darmstadt. They are best known from the picturesque gorges which have been cut through them by the Rhine below Bingen and by the Moselle below Treves. They reappear from under younger formations in Brittany, in the Harz and Thuringia, and are exposed in Franconia, Saxony, Silesia, North Moravia and eastern Galicia. The principal subdivisions of the system in the more typical areas are indicated in Table I.

This threefold subdivision, with a central mass of calcareous strata, is traceable westwards through Belgium (where the Calcaire de Givet represents the *Stringocephalus* limestone of the Eifel) and eastwards into the Harz. The rocks reappear with local petrographical modifications, but with a remarkable persistence of general palaeontological characters, in Eastern Thuringia, Franconia, Saxony, Silesia, the north of Moravia and East Galicia. Devonian rocks have been detected among the crumpled rocks of the Styrian Alps by means of the evidence of abundant corals, cephalopods, gasteropods, lamellibranchs and other organic remains. Perhaps in other tracts of the Alps, as well as in the Carpathian range, similar shales, limestones and dolomites, though as yet unfossiliferous, but containing ores of silver, lead, mercury, zinc, cobalt and other metals, may be referable to the Devonian system.

In the centre of Europe, therefore, the Devonian rocks consist of a vast thickness of dark-grey sandy and shaly rocks, with occasional seams of limestone, and in particular with one thick central calcareous zone. These rocks are characterized in the lower zones by numerous broad-winged spirifers and by peculiar trilobites (*Phacops, Homalonotus*, &c.) which, though generically like those of the Silurian system, are specifically distinct. The central calcareous zone abounds in corals and crinoids as well as in numerous brachiopods. In the highest bands a profusion of coiled cephalopods (*Clymenia*) occurs in some of the limestones, while the shales are crowded with a small but characteristic ostracod crustacean (*Cypridina*). Here and there traces of fishes have been found, more especially in the Eifel, but seldom in such a state of preservation as to warrant their being assigned to any definite place in the zoological scale. Subsequently, however, E. Beyrich has described from Gerolstein in the Eifel an undoubted species of *Pterichthys*, which, as it cannot be certainly identified with any known form, he names *P. Rhenanus*. A *Coccosteus* has been described by F. A. Roemer from the Harz, and still later one has been cited from Bicken near Herborn by V. Koenen; but, as Beyrich points out, there may be some doubt as to whether the latter is not a *Pterichthys*. A *Cunacanthus*, seemingly undistinguishable from the *C. Bohemicus* of Barrande's Étage G, has also been

obtained from the Lower Devonian "Nereitenschichten" of Thuringia. The characteristic *Holoptychius nobilissimus* has been detected in the Psammite de Condros, which in Belgium forms a characteristic sandy portion of the Upper Devonian rocks. These are interesting facts, as helping to link the Devonian and Old Red Sandstone types together. But they are as yet too few and unsupported to warrant any large deduction as to the correlations between these types.

It is in the north-east of Europe that the Devonian and Old Red Sandstone appear to be united into one system, where the limestones and marine organisms of the one are interstratified with the fish-bearing sandstones and shales of the other. In Russia, as was shown in the great work *Russia and the Ural Mountains* of Murchison, De Verneuil and Keyserling, rocks intermediate between the Upper Silurian and Carboniferous Limestone formations cover an extent of surface larger than the British Islands. This great development arises not from the thickness but from the undisturbed horizontal character of the strata. Like the Silurian formations described elsewhere, they remain to this day nearly as flat and unaltered as they were originally laid down. Judged by mere vertical depth, they present but a meagre representative of the massive Devonian greywacke and limestone of Germany, or of the Old Red Sandstone of Britain. Yet vast though the area is over which they form the surface rock, it is probably only a small portion of their total extent; for they are found turned up from under the newer formations along the flank of the Ural chain. It would thus seem that they spread continuously across the whole breadth of Russia in Europe. Though almost everywhere undisturbed, they afford evidence of some terrestrial oscillation between the time of their formation and that of the Silurian rocks on which they rest, for they are found gradually to overlap Upper and Lower Silurian formations.

The chief interest of the Russian rocks of this age lies in the fact, first signalized by Murchison and his associates, that they unite within themselves the characters of the Devonian and the Old Red Sandstone types. In some districts they consist largely of limestones, in others of red sandstones and marls. In the former they present molluscs and other marine organisms of known Devonian species; in the latter they afford remains of fishes, some of which are specifically identical with those of the Old Red Sandstone of Scotland. The distribution of these two palaeontological types in Russia is traced by Murchison to the lithological character of the rocks, and consequent original diversities of physical conditions, rather than to differences of age. Indeed cases occur where in the same band of rock Devonian shells and Old Red Sandstone fishes lie commingled. In the belt of the formation which extends southwards from Archangel and the White Sea, the strata consist of sands and marls, and contain only fish remains. Traced through the Baltic provinces, they are found to pass into red and green marls, clays, thin limestones and sandstones, with beds of gypsum. In some of the calcareous bands such fossils occur as *Orthis striatula*, *Spiriferina prisca*, *Leptaena productoides*, *Spirifer calcaratus*, *Spirorbis omphaloides* and *Orthoceras subfusiforme*. In the higher beds *Holoptychius* and other well-known fishes of the Old Red Sandstone occur. Followed still farther to the south, as far as the watershed between Orel and Voronezh, the Devonian rocks lose their red colour and sandy character, and become thin-bedded yellow limestones, and dolomites with soft green and blue marls. Traces of salt deposits are indicated by occasional saline springs. It is evident

TABLE I.

	Stages.	Ardennes.	Rhineland.	Brittany and Normandy.	Bohemia.	Harz.
Upper Devonian.	Famennien (*Clymenia* beds).	Limestone of Etroeungt. Psammites of Condroz (sandy series). Slates of Famenne (shaly series).	*Cypridina* slates. Pön sandstone (Sauerland). Crumbly limestone (Kramenzelkalk) with *Clymenia*. Neheim slates in Sauerland, and diabases, tuffs, &c., in Dillmulde, &c.	Slates of Rostellec.		*Cypridina* slates. *Clymenia* limestone and limestone of Adenau.
	Frasnien (*Intumescens* beds).	Slates of Matagne. Limestones, marls and shale of Frasne, and red marble of Flanders.	Adorf limestone of Waldeck and shales with *Goniatites* (Eifel and Aix) = Budesheimer shales. Marls, limestone and dolomite with *Rhynchonella cuboides* (Flinz in part). Iberg limestone of Dillmulde.	Limestone of Cop-Choux and green slates of Travuliors.		Iberg limestone and Winterberg limestone; also Adorf limestone and shales (Budesheim).
Middle Devonian.	Givetien (*Stringocephalus* beds).	Limestone of Givet.	*Stringocephalus* limestone, ironstone of Brilon and Lahnmulde. Upper Lenne shales, crinoidal limestone of Eifel, red sandstones of Aix. Tuffs and diabases of Brilon and Lahnmulde. Red conglomerate of Aix.	Limestones of Chalonnes, Montjean and l'Ecochère	H_2 (Barrande) Dark plant-bearing shales. H_1.	*Stringocephalus* shales with Flaser and Knollenkalk. Wissenbach slates.
	Eifelien (*Calceola* beds).	*Calceola* slates and limestones of Couvin. Greywacke with *Spirifer cultrijugatus*.	*Calceola* beds, Wissenbach slates, Lower Lenne beds, Guntroder limestone and clay slate of Lahnmulde, Dillmulde, Wildungen, Griefenstein limestone, Ballersbach limestone.	Slates of Poulguen, greywacke of Fret.	G_3 Cephalopod limestone. G_2 Tentaculite limestone. G_1 Knollenkalk and mottled Mnenian limestone.	*Calceola* beds. Nereite slates, slates of Wieda and limestones of Hasselfeld.
Lower Devonian.	Coblentzien.	Greywacke of Herges. Shales and conglomerate of Burnot with quartzite, of Bierlé and red slates of Vireux, greywacke of Vireux, greywacke of Montigny, sandstone of Anor.	Upper Coblentz slates. Red sandstone of Eifel, Coblentz quartzite, lower Coblentz slates. Hunsrück and Siegener greywacke and slates. Taunus quartzite and greywacke.	Limestones of Erbray, Brulon, Viré and Néhou, greywacke of Faou, sandstone of Gahard.	F_2 of Barrande. White Konjeprus limestone with Hercynian fauna.	Haupt quartzite (of Lossen) = Rammelsberg slates, Schalker slates = Kahleberg sandstone. Hercynian slates and limestones.
	Gédinnien.	Slates of St Hubert and Fooz, slates of Mondrepuits, arkose of Weismes, conglomerate of Fépin.	Slates of Gédinne	Slates and quartzites of Plougastel.		

that the geographical conditions of the Russian area during the Devonian period must have closely resembled those of the Rhine basin and central England during the Triassic period. The Russian Devonian rocks have been classified in Table II. There is an unquestionable passage of the uppermost Devonian rocks of Russia into the base of the Carboniferous system.

The Lower Devonian of the Harz contains a fauna which is very different from that of the Rhenish region; to this facies the name "Hercynian" has been applied, and the correlation of the strata has been a source of prolonged discussion among continental geologists. A similar fauna appears in Lower Devonian of Bohemia, in Brittany (limestone of Erbray) and in the Urals. The Upper Devonian of the Harz passes up into the Culm.

In the eastern Thuringian Fichtelgebirg the upper division is represented by *Clymenia* limestone and *Cypridina* slates with Adorf limestone, diabase and Planschwitzer tuff in the lower part. The middle division has diabases and tuffs at the top with Tentaculite and Nereite shales and limestones below. The upper part of the Lower Devonian, the sandy shale of Steinach, rests unconformably upon Silurian rocks. In the Carnic Alps are coral reef limestones, the equivalents of the Iberg limestone, which attain an enormous thickness; these are underlain by coral limestone with fossils similar to those of the Konjeprus limestone of Bohemia; below these are shales and nodular limestones with goniatites. The Devonian rocks of Poland are sandy in the lower, and more calcareous in the upper parts. They are of interest because while the upper portions agree closely with the Rhenish facies, from the top of the Coblentzien upwards, in the sandy beds near the base Old Red Sandstone fishes (*Coccosteus*, &c.) are found. In France Devonian rocks are found well developed in Brittany, as indicated in the table, also in Normandy and Maine; in the Boulonnais district only the middle and upper divisions are known. In south France in the neighbourhood of Cabrières, about Montpellier and in the Montagne Noire, all three divisions are found in a highly calcareous condition. Devonian rocks are recognized, though frequently much metamorphosed, on both the northern and southern flanks of the Pyrenees; while on the Spanish peninsula they are extensively developed. In Asturias they are no less than 3280 ft. thick, all three divisions and most of the central European subdivisions are present. In general, the Lower Devonian fossils of Spain bear a marked resemblance to those of Brittany.

Asia.—From the Ural Mountains eastward, Devonian rocks have been traced from point to point right across Asia. In the Altai Mountains they are represented by limestones of Coblentzien age with a fauna possessing Hercynian features. The same features are observed in the Devonian of the Kougnetsk basin, and in Turkestan. Well-developed quartzites with slates and diabases are found south of Yarkand and Khotan. Middle and Upper Devonian strata are widespread in China. Upper Devonian rocks are recorded from Persia, and from the Hindu Kush on the right bank of the Chitral river.

England.—In England the original Devonian rocks are developed in Devon and Cornwall and west Somerset. In north Devonshire these rocks consist of sandstones, grits and slates, while in south Devon there are, in addition, thick beds of massive limestone, and intercalations of lavas and tuffs. The interpretation of the stratigraphy in this region is a difficult matter, partly on account of the absence of good exposures with fossils, and partly through the disturbed condition of the rocks. The system has been subdivided as shown in Table III.

The fossil evidence clearly shows the close agreement of the Rhenish and south Devonshire areas. In north Devonshire the Devonian rocks pass upward without break into the Culm.

North America.—In North America the Devonian rocks are extensively developed; they have been studied most closely in the New York region, where they are classified according to Table IV.

The classification below is not capable of application over the states generally and further details are required from many of the regions where Devonian rocks have been recognized, but everywhere the broad threefold division seems to obtain. In Maryland the following arrangement has been adopted—(1) Helderberg = Coeymans; (2) Oriskany; (3) Romney = Erian; (4) Jennings = Genesee and Portage; (5) Hampshire = Catskill in part. In the interior the Helderbergian is missing and the system commences with (1) Oriskany, (2) Onondaga, (3) Hamilton, (4) Portage (and Genesee), (5) Chemung.

The Helderbergian series is mainly confined to the eastern part of the continent; there is a northern development in Maine, and in Canada (Gaspé, New Brunswick, Nova Scotia and Montreal); an Appalachian belt, and a lower Mississippian region. The series as a whole is mainly calcareous (2000 ft. in Gaspé), and thins out towards the west. The fauna has Hercynian affinities. The Oriskany formation consists largely of coarse sandstones; it is thin in New York, but in Maryland and Virginia it is several hundred feet thick. It is more widespread than the underlying Helderbergian. The Lower Devonian appears to be thick in northern Maine and in Gaspé, New Brunswick and Nova Scotia, but neither the palaeontology nor the stratigraphy has been completely worked out.

TABLE II.

	North-West Russia.		Central Russia.	Petchoraland.	Ural Region.
Upper	Red sandstone (Old Red).	Limestones with *Spirifer Verneuili* and *Sp. Archiaci*.	Limestones with *Arca oreliana*. Limestones with *Sp. Verneuili* and *Sp. Archiaci*.	Domanik slates and limestones with *Sp. Verneuili*.	*Cypridina* slates, *Clymenia* limestones (Famennien). Limestones with *Gephyoceras intumescens* and *Rhynchonella cuboides* (Frasnien).
Middle.	Dolomites and limestones with *Spirifer Anossofi*.		Marl with *Spirifer Anossofi* and corals.		Limestones and slates with *Sp. Anossofi* (Givétien). Limestones and slates with *Pentamerus baschkiricus* (Eifélien).
	Lower sandstone (Old Red).				
Lower.	Absent.				Limestones and slates of the Yuresan and Ufa rivers, slate and quartzite, marble of Byelaya and of Bogoslovsk, phyllitic schists and quartzite.

TABLE III.

	North Devon and West Somerset.	South Devon.
Upper.	Pilton group. Grits, slates and thin limestones.	Ashburton slates.
	Baggy group. Sandstones and slates.	Livaton slates.
	Pickwell Down group. Dark slates and grits.	Red and green *Entomis* slates (Famennien).
	Morte slates (?).	Red and grey slates with tuffs.
		Chudleigh goniatite limestone Petherwyn beds (Frasnien).
Middle.	Ilfracombe slates with lenticles of limestone.	Torquay and Plymouth limestones and Ashprington volcanic series. (Givétien and Eifélien.)
	Combe Martin grits and slates.	Slates and limestones of Hope's Nose.
Lower.	Hangman grits and slates.	Looe beds (Cornwall).
	Lynton group, grits and calcareous slates.	Meadfoot, Cockington and Warberry series of slates and greywackes. (Coblentzien and Gédinnien.)
	Foreland grits and slates.	

In the Middle Devonian the thin clastic deposits at the base, Esopus and Schoharie grits, have not been differentiated west of the Appalachian region; but the Onondaga limestones are much more extensive. The Erian series is often described as the Hamilton series outside the New York district, where the *Marcellus* shales are grouped together with the Hamilton shales, and numerous local subdivisions are included, as in Ohio, Kentucky and Tennessee. The rocks are mostly shales or slates, but limestones predominate in the western development. In Pennsylvania the Hamilton series is from 1500 ft. to 5000 ft. thick, but in the more calcareous western extension it is much thinner. The *Marcellus* shales are bituminous in places.

The Senecan series is composed of shallow-water deposits; the Tully limestone, a local bed in New York, thins out in places into a layer of pyrites which contains a remarkable dwarfed fauna. The bituminous Genesee shales are thickest in Pennsylvania (300 ft.); 25 ft. on Lake Erie. The shales and sandstones of the Portage formation reach 1000 ft. to 1400 ft. in western New York. In the Chautauquan series the Chemung formation is not always clearly separable from the Portage beds, it is a sandstone and conglomerate

TABLE IV.

	Groups.	Formations.	Probable European Equivalent.
Upper.	Chautauquan.	Chemung beds with Catskill as a local facies.	Famennien.
	Senecan.	Portage beds (Naples, Ithaca and Oneonta shales as local facies).	
		Genesee shales.	
		Tully limestone.	Frasnien.
Middle.	Erian.	Hamilton shale.	Givétien.
		Marcellus shale.	
	Ulsterian.	Onondaga (Corniferous) limestone.	Eifélien.
		Schoharie grit.	
		Esopus grit (Caudagalh grit).	
Lower.	Oriskanian.	Oriskany sandstone.	Coblentzien.
	Helderbergian.	Kingston beds.	
		Becraft limestone.	Gédinnien.
		New Scotland beds.	
		Coeymans limestone.	

formation which reaches its maximum thickness (8000 ft.) in Pennsylvania, but thins rapidly towards the west. In the Catskill region the Upper Devonian has an Old Red facies—red shales and sandstones with a freshwater and brackish fauna.

Although the correlation of the strata has only advanced a short distance, there is no doubt as to the presence of undifferentiated Devonian rocks in many parts of the continent. In the Great Plains this system appears to be absent, but it is represented in Colorado, Utah, Nevada, Wyoming, Montana, California and Arizona; Devonian rocks occur between the Sierras and the Rocky Mountains, in the Arbuckle Mountains of Oklahoma and in Texas. In the western interior limestones predominate; 6000 ft. of limestone are found at Eureka, Nevada, beneath 2000 ft. of shale. On the Pacific coast metamorphism of the rocks is common, and lava-flows and tuffs occur in them.

In Canada, besides the occurrences previously mentioned in the eastern region, Devonian strata are found in considerable force along the course of the Mackenzie river and the Canadian Rockies, whence they stretch out into Alaska. It is probable, however, that much that is now classed as Devonian in Canada will prove, on fossil evidence to be Carboniferous.

South America, Africa, Australia, &c.—In South America the Devonian is well developed; in Argentina, Bolivia, Brazil, Peru and the Falkland Islands, the palaeontological horizon is about the junction of the Lower and Middle divisions, and the fauna has affinities with the Hamilton shales of North America. Nearly allied to the South American Devonian is that of South Africa, where they are represented by the Bokkeveld beds in the Cape system. In Australia we find Lower Devonian consisting of coarse littoral deposits with volcanic rocks; and a Middle division with coral limestones in Victoria, New South Wales and Queensland; an Upper division has also been observed. In New Zealand the Devonian is well exposed in the Reefton mining field; and it has been suggested that much of the highly metamorphosed rock may belong to this system.

Stratigraphy of the Old Red Sandstone Facies.

The Old Red Sandstone of Britain, according to Sir Archibald Geikie, "consists of two subdivisions, the lower of which passes down conformably into the Upper Silurian deposits, the upper shading off in the same manner into the base of the Carboniferous system, while they are separated from each other by an unconformability." The Old Red strata appear to have been deposited in a number of elongated lakes or lagoons, approximately parallel to one another, with a general alignment in a N.E.-S.W. direction. To these areas of deposit Sir A. Geikie has assigned convenient distinctive names.

In Scotland the two divisions of the system are sharply separated by a pronounced unconformability which is probably the result of a prolonged interval of erosion. In the central valley between the base of the Highlands and the southern uplands lay "Lake Caledonia." Here the lower division is made up of some 10,000 ft. of shallow-water deposits, reddish-brown, yellow and grey sandstones and conglomerates, with occasional "cornstones," and thin limestones. The grey flagstones with shales are almost confined to Forfarshire, and are known as the "Arbroath flags." Interbedded volcanic rocks, andesites, dacites, diabases, with agglomerates and tuffs constitute an important feature, and attain a thickness of 6000 ft. in the Pentland and Ochil hills. A line of old volcanic vents may be traced in a direction roughly parallel to the trend of the great central valley. On the northern side of the Highlands was "Lake Orcadie," presumably much larger than the foregoing lake, though its boundaries are not determinable. It lay over Moray Firth and the east of Ross and Sutherland, and extended from Caithness to the Orkney Islands and S. Shetland. It may even have stretched across to Norway, where similar rocks are found in Sognefjord and Dalsfjord, and may have had communications with some parts of northern Russia. Very characteristic of this area are the Caithness flags, dark grey and bituminous, which, with the red sandstones and conglomerates at their base, probably attain a thickness of 16,000 ft. The somewhat peculiar fauna of this series led Murchison to class the flags as Middle Devonian. In the Shetland Islands contemporaneous volcanic rocks have been observed. Over the west of Argyllshire lay "Lake Lorne"; here the volcanic rocks predominate, they are intercalated with shallow-water deposits. A similar set of rocks occupy the Cheviot district.

The upper division of the Old Red Sandstone is represented in Shropshire and South Wales by a great series of red rocks, shales, sandstones and marls, some 10,000 ft. thick. They contain few fossils, and no break has yet been found in the series. In Scotland this series was deposited in basins which correspond only partially with those of the earlier period. They are well developed in central Scotland over the lowlands bordering the Moray Firth. Interbedded lavas and tuffs are found in the island of Hoy. An interesting feature of this series is the occurrence of great crowds of fossil fishes in some localities, notably at Dura Den in Fife. In the north of England this series rests unconformably upon the Lower Old Red and the Silurian.

Flanking the Silurian high ground of Cumberland and Westmorland, and also the Lammermuir hills and in Flint and Anglesey, a brecciated conglomerate, presenting many of the characters of a glacial deposit in places, has often been classed with the Old Red Sandstone, at least in parts, it is more likely to belong to the Carboniferous system. In Ireland the lower division appears to be represented by the Dingle beds and Glengariff grits, while Kerry rocks and the Kiltorcan beds of Cork are the equivalents of the upper division. Rocks of Old Red type, both lower and upper, are found in Spitzbergen and in Bear Island. In New Brunswick and Nova Scotia the Old Red facies is extensively developed. The Gaspé sandstones have been estimated at 7036 ft. thick. In parts of western Russia Old Red Sandstone fossils are found in beds intercalated with others containing marine fauna of the Devonian facies.

Devonian and Old Red Sandstone Faunas.

The two types of sediment formed during this period—the *marine* Devonian and the *lagoonal* Old Red Sandstone—representing as they do two different but essentially contemporaneous phases of physical condition, are occupied by two strikingly dissimilar faunas. Doubtless at all times there were regions of the earth that were marked off no less clearly from the normal marine conditions of which we have records; but this period is the earliest in which these variations of environment are made obvious. In some respects the faunal break between the older Silurian below and the younger Carboniferous above is not strongly marked; and in certain areas a very close relationship can be shown to exist between the older Devonian and the former, and the younger Devonian and the latter. Nevertheless, taken as a whole, the life of this period bears a distinct stamp of individuality.

The two most prominent features of the Devonian seas are presented by corals and brachiopods. The corals were abundant individually and varied in form; and they are so distinctive of the period that no Devonian species has yet been found either in the Silurian or in the Carboniferous. They built reefs, as in the present day, and contributed to the formation of limestone masses in Devonshire, on the continent of Europe and in North America. Rugose and tabulate forms prevailed; among the former the cyathophyllids (*Cyathophyllum*) were important, *Phillipsastraea*, *Zaphrentis*, *Acervularia* and the curious *Calceola* (*sandalina*), an operculate genus which has given palaeontologists much trouble in its diagnosis, for it has been regarded as a pelecypod (hippurite) and

a brachiopod. The tabulate corals were represented by *Favosites*, *Michelinia*, *Pleurodictyum*, *Fistulipora*, *Pachypora* and others. *Heliolites* and *Plasmopora* represent the alcyonarians. Stromatoporoids were important reef builders. A well-known fossil is *Receptaculites*, a genus to which it has been difficult to assign a definite place; it has been thought to be a sponge, it may be a calcareous alga, or a curious representative of the foraminifera.

In the Devonian period the brachiopods reached the climax of their development: they compose three-quarters of the known fauna and more than 1100 species have been described. Changes were taking place from the beginning of the period in the relative importance of genera; several Silurian forms dropped out, and new types were coming in. A noticeable feature was the development of broad-winged shells in the genus *Spirifer*, other spirifers were *Amboccelia*, *Uncites*, *Verneuilia*. Orthids and pentamerids were waning in importance, while the productids (*Productus*, *Chonetes*, *Strophalosia*) were increasing. The strophomenids were still flourishing, represented by the genera *Leptaena*, *Stropheodonta*, *Kayserella*, and others. The ancient *Lingula*, along with *Crania* and *Orbiculoidea*, occur among the inarticulate forms. Another long-lived and wide-ranging species is *Atrypa reticularis*. The athyrids were very numerous (*Athyris*, *Retzia*, *Merista*, *Meristella*, *Kayserina*, &c.) and the rhynchonellids were well represented by *Pugnax*, *Hypothyris*, and several other genera. The important group of terebratulids appears in this system; amongst them *Stringocephalus* is an eminently characteristic Devonian brachiopod; others are *Dielasma*, *Cryptonella*, *Rensselaeria* and *Orishania*.

The pelecypod molluscs were represented by *Pterinea*, abundant in the lower members along with other large-winged forms, and by *Cucullella*, *Buchiola* and *Pterinopecten* in the upper members of the system. Other genera are *Actinodesma*, *Cardiola*, *Nucula*, *Megalodon*, *Aviculopecten*, &c. Gasteropods were becoming more important, but the simple capulid forms prevailed: *Platyceras* (*Capulus*), *Straparollus*, *Pleurotomaria*, *Murchisonia*, *Macrocheilina*, *Euomphalus*. Among the pteropods, *Tentaculites* was very abundant in some quarters; others were *Conularia* and *Styliolina*. In the Devonian period the cephalopods began to make a distinct advance in numbers, and in development. The goniatites appear with the genera *Anarcestes*, *Agoniatites*, *Tornoceras*, *Goniatites* and others; and in the upper strata the clymenoids, forerunners of the later ammonoids, began to take definite shape. While several new nautiloids (*Homaloceras*, *Ryticeras*, &c.) made their appearance several of the older genera still lived on (*Orthoceras*, *Poterioceras*, *Actinoceras*).

Crinoids were very abundant in some parts of the Devonian sea, though they were relatively scarce in others; they include the genera *Melocrinus*, *Haplocrinus*, *Cupressocrinus*, *Calceocrinus* and *Fleuthrocrinus*. The cystideans were falling off (*Proteocystis*, *Tiaracrinus*), but blastoids were in the ascendant (*Nucleocrinus*, *Codaster*, &c.). Both brittle-stars, *Ophiura*, *Palaeophiura*, *Eugaster*, and true starfishes, *Palaeaster*, *Aspidosoma*, were present, as well as urchins (*Lepidocentrus*).

When we turn to the crustaceans we have to deal with two distinct assemblages, one purely marine, trilobitic, the other mainly lacustrine or lagoonal with a eurypteridian facies. The trilobites had already begun to decline in importance, and as happens not infrequently with degenerating races of beasts and men, they began to develop strange eccentricities of ornamentation in some of their genera. A number of Silurian genera lived on into the Devonian period, and some gradually developed into new and distinctive forms; such were *Proetus*, *Harpes*, *Cheirurus*, *Bronteus* and others. Distinct species of *Phacops* mark the Lower and Upper Devonian respectively, while the genus *Dalmania* (*Odontochile*) was represented by species with almost world-wide range. The Ostracod *Entomis* (*Cypridina*) was extremely abundant in places—*Cypridinen-Schiefer*—while the true *Cypridina* was also present along with *Beyrichia*, *Leperditia*, &c. The Phyllocarids, *Echinocaris*, *Eleuthrocaris*, *Tropidocaris*, are common in the United States. It is in the Old Red Sandstone that the eurypterids are best preserved; foremost among these was *Pterygotus*; *P. anglicus* has been found in Scotland with a length of nearly 6 ft.; *Eurypterus*, *Slimonia*, *Stylonurus* were other genera.

Insects appear well developed, including both orthopterous and neuropterous forms, in the New Brunswick rocks. Mr Scudder believed he had obtained a specimen of Orthoptera in which a stridulating organ was present. A species of *Ephemera*, allied to the modern may-fly, had a spread of wing extending to 5 in. In the Scottish Old Red Sandstone myriapods, *Kampecaris* and *Archidesmus*, have been described; they are somewhat simpler than more recent forms, each segment being separate, and supplied with only one pair of walking legs. Spiders and scorpions also lived upon the land.

The great number of fish remains in the Devonian and Old Red strata, coupled with the truly remarkable characters possessed by some of the forms, has caused the period to be described as the "age of fishes." As in the case of the crustaceans, referred to above, we find one assemblage more or less peculiar to the freshwater or brackish conditions of the Old Red, and another characteristic of the marine Devonian; on the whole the former is the richer in variety, but there seems little doubt that quite a number of genera were capable of living in either environment, whatever may have been the real condition of the Old Red waters. Foremost in interest are the curious ostracoderms, a remarkable group of creatures possessing many of the characteristics of fishes, but more probably belonging to a distinct class of organisms, which appears to link the vertebrates with the arthropods. They had come into existence late in Silurian times; but it is in the Old Red strata that their remains are most fully preserved. They were abundant in the fresh or brackish waters of Scotland, England, Wales, Russia and Canada, and are represented by such forms as *Pteraspis*, *Cephalaspis*, *Cyathaspis*, *Tremataspis*, *Bothriolepis* and *Pterichthys*.

In the lower members of the Old Red series *Dipterus*, and in the upper members *Phaneropleuron*, represented the dipnoid lung-fishes; and it is of extreme interest to note that a few of these curious forms still survive in the African *Protopterus*, the Australian *Ceratodus* and the South American *Lepidosiren*,—all freshwater fishes. Distantly related to the lung-fishes were the singular arthrodirans, a group possessing the unusual faculty of moving the head in a vertical plane. These comprise the wide-ranging *Coccosteus* with *Homosteus* and *Dinichthys*, the largest fish of the period. The latter probably reached 20 ft. in length; it was armed with exceedingly powerful jaws provided with turtle-like beaks. Sharks were fairly prominent denizens of the sea; some were armed with cutting teeth, others with crushing dental plates; and although they were on the whole marine fishes, they were evidently able to live in fresher waters, like some of their modern representatives, for their remains, mostly teeth and large dermal spines, are found both in the Devonian and Old Red rocks. *Mesacanthus*, *Diplacanthus*, *Climatius*, *Cheiracanthus* are characteristic genera. The crossopterygians, ganoids with a scaly lobe in the centre of the fins, were represented by *Holoptychius* and *Glyptopomus* in the Upper Old Red, and by such genera as *Diplopterus*, *Osteolepis*, *Gyroptychius* in the lower division. The *Polypterus* of the Nile and *Calamoichthys* of South Africa are the modern exemplars of this group. *Cheirolepis*, found in the Old Red of Scotland and Canada, is the only Devonian representative of the actinopterygian fishes. The cyclostome fishes have, so far, been discovered only in Scotland, in the tiny *Palaeospondylus*. Amphibian remains have been found in the Devonian of Belgium; and footprints supposed to belong to a creature of the same class (*Thinopus antiquus*) have been described by Professor Marsh from the Chemung formation of Pennsylvania.

Plant Life.—In the lacustrine deposits of the Old Red Sandstone we find the earliest well-defined assemblage of terrestrial plants. In some regions so abundant are the vegetable remains that in places they form thin seams of veritable coal. These plants evidently flourished around the shores of the lakes and lagoons in which their remains were buried along with the other forms of life. Lycopods and ferns were the predominant types; and it is important to notice that both groups were already highly developed. The ferns include the genera *Sphenopteris*, *Megalopteris*, *Archaeopteris*, *Neuropteris*. Among the Lycopods are *Lycopodites*, *Psilophyton*, *Lepidodendron*. Modern horsetails are represented by *Calamocladus*, *Asterocalamites*, *Annularia*. Of great interest are the genera *Cordaites*, *Araucarioxylon*, &c., which were synthetic types, uniting in some degree the Coniferae and the Cycadofilicales. With the exception of obscure markings, aquatic plants are not so well represented as might have been expected; *Parka*, a common fossil, has been regarded as a water plant with a creeping stem and two kinds of sporangia in sessile sporocarps.

Physical Conditions, &c.—Perhaps the most striking fact that is brought out by a study of the Devonian rocks and their fossils is the gradual transgression of the sea over the land, which took place quietly in every quarter of the globe shortly after the beginning of the period. While in most places the Lower Devonian sediments succeed the Silurian formations in a perfectly conformable manner, the Middle and Upper divisions, on account of this encroachment of the sea, rest unconformably upon the older rocks, the Lower division being unrepresented. This is true over the greater part of South America, so far as our limited knowledge goes, in much of the western side of North America, in western Russia, in Thuringia and other parts of central Europe. Of the distribution of land and sea and the position of the coast lines in Devonian times we can state nothing with precision. The known deposits all point to shallow waters of epicontinental seas; no abyssal formations have been recognized. E. Kayser has pointed out the probability of a Eurasian sea province extending through Europe towards the east, across north and central Asia towards Manitoba in Canada, and an American sea province embracing the United States, South America and South Africa. At the same time there existed a great North Atlantic land area caused partly by the uplift of the Caledonian range just before the beginning of the period, which stretched across north Europe to eastern Canada; on the fringe of this land the Old Red Sandstone was formed.

In the European area Barrois has indicated the existence of three zones of deposition (1) A northern, Old Red, region,

including Great Britain, Scandinavia, European Russia and Spitzbergen; here the land was close at hand; great brackish lagoons prevailed, which communicated more or less directly with the open sea. In European Russia, during its general advance, the sea occasionally gained access to wide areas, only to be driven off again, during pauses in the relative subsidence of the land, when the continued terrigenous sedimentation once more established the lagoonal conditions. These alternating phases were frequently repeated. (2) A middle region, covering Devonshire and Cornwall, the Ardennes, the northern part of the lower Rhenish mountains, and the upper Harz to the Polish Mittelgebirge; here we find evidence of a shallow sea, clastic deposits and a sublittoral fauna. (3) A southern region reaching from Brittany to the south of the Rhenish mountains, lower Harz, Thuringia and Bohemia; here was a deeper sea with a more pelagic fauna. It must be borne in mind that the above-mentioned regions are intended to refer to the time when the extension of the Devonian sea was near its maximum. In the case of North America it has been shown that in early and middle Devonian time more or less distinct faunas invaded the continent from five different centres, viz. the Helderberg, the Oriskany, the Onondaga, the southern Hamilton and the north-western Hamilton; these reached the interior approximately in the order given.

Towards the close of the period, when the various local faunas had mingled one with another and a more generalized life assemblage had been evolved, we find many forms with a very wide range, indicating great uniformity of conditions. Thus we find identical species of brachiopods inhabiting the Devonian seas of England, France, Belgium, Germany, Russia, southern Asia and China; such are, *Hypothyris* (*Rhynchonella*) *cuboides*, *Spirifer disjunctus* and others. The fauna of the *Calceola* shales can be traced from western Europe to Armenia and Siberia; the *Stringocephalus* limestones are represented in Belgium, England, the Urals and Canada; and the (*Gephyroceras*) *intumescens* shales are found in western Europe and in Manitoba.

The Devonian period was one of comparative quietude; no violent crustal movements seem to have taken place, and while some changes of level occurred towards its close in Great Britain, Bohemia and Russia, generally the passage from Devonian to Carboniferous conditions was quite gradual. In later periods these rocks have suffered considerable movement and metamorphism, as in the Harz, Devonshire and Cornwall, and in the Belgian coalfields, where they have frequently been thrust over the younger Carboniferous rocks. Volcanic activity was fairly widespread, particularly during the middle portion of the period. In the Old Red rocks of Scotland there is a great thickness (6000 ft.) of igneous rocks, including diabases and andesitic lavas with agglomerates and tuffs. In Devonshire diabases and tuffs are found in the middle division. In west central Europe volcanic rocks are found at many horizons, the most common rocks are diabases and diabase tuffs, *schalstein*. Felsitic lavas and tuffs occur in the Middle Devonian of Australia. Contemporaneous igneous rocks are generally absent in the American Devonian, but in Nova Scotia and New Brunswick there appear to be some.

There is little evidence as to the climate of this period, but it is interesting to observe that local glacial conditions *may* have existed in places, as is suggested by the coarse conglomerate with striated boulders in the upper Old Red of Scotland. On the other hand, the prevalence of reef-building corals points to moderately warm temperatures in the Middle Devonian seas.

The economic products of Devonian rocks are of some importance: in many of the metamorphosed regions veins of tin, lead, copper, iron are exploited, as in Cornwall, Devon, the Harz; in New Zealand, gold veins occur. Anthracite of Devonian age is found in China and a little coal in Germany, while the Upper Devonian is the chief source of oil and gas of western Pennsylvania and south-western New York. In Ontario the middle division is oil-bearing. Black phosphates are worked in central Tennessee, and in England the marls of the "Old Red" are employed for brick-making.

REFERENCES.—The literature of the Devonian rocks and fossils is very extensive; important papers have been contributed by the following geologists: J. Barrande, C. Barrois, F. Béchard, E. W. Benecke, L. Beushausen, A. Champernowne, J. M. Clarke, Sir J. W. Dawson, A. Denckmann, J. S. Diller, E. Dupont, S. Fisch, J. Fournet, Sir A. Geikie, G. Gürich, R. Haeusse, E. Kayser, C. and M. Koch, A. von Koenen, Hugh Miller, D. P. Oehlert, C. S. Prosser, P. de Rouville, C. Schuchert, T. Tschernyschew, E. O. Ulrich, W. A. E. Umber, P. N. Wenjukoff, G. F. Whidborne, J. F. Whiteaves and H. S. Williams. Sedgwick and Murchison's original descriptions appeared in the *Trans. Geol. Soc.* (and series, vol. v., 1839). Good general accounts will be found in Sir A. Geikie's *Text-Book of Geology* (vol. ii., 4th ed., 1903), in E. Kayser's *Lehrbuch der Geologie* (vol. ii., 2nd ed., 1902), and, for North America, in Chamberlin and Salisbury's *Geology* (vol. ii., 1906). See the *Index to the Geological Maps* (1864–1903), and in subsequent annual volumes; *Geological Literature added to the Geological Society's Library* (London), annually since 1893; and the *Neues Jahrbuch für Min., Geologie und Palaeontologie* (Stuttgart, 2 annual volumes). The U.S. Geological Survey publishes at intervals a *Bibliography and Index of North American Geology, &c.*, and this (*e.g.* Bulletin 301,—the *Biblioq. and Index* for 1901–1905) contains numerous references for the Devonian system in North America. (J. A. H.)

DEVONPORT, a municipal, county and parliamentary borough of Devonshire, England, contiguous to East Stonehouse and Plymouth, the seat of one of the royal dockyards, and an important naval and military station. Pop. (1901) 70,437. It is situated immediately above the N.W. angle of Plymouth Sound, occupying a triangular peninsula formed by Stonehouse Pool on the E. and the Hamoaze on the W. It is served by the Great Western and the London & South Western railways. The town proper was formerly enclosed by a line of ramparts and a ditch excavated out of the limestone, but these are in great part demolished. Adjoining Devonport are East Stonehouse (an urban district, pop. 15,111), Stoke and Morice Town, the two last being suburbs of Devonport. The town hall, erected in 1821–1822 partly after the design of the Parthenon, is distinguished by a Doric portico; while near it are the public library, in Egyptian style, and a conspicuous Doric column built of Devonshire granite. This monument, which is 100 ft. high, was raised in commemoration of the naming of the town in 1824. Other institutions are the Naval Engineering College, Keyham (1880); the municipal technical schools, opened in 1899, the majority of the students being connected with the dockyard; the naval barracks, Keyham (1885); the Raglan barracks and the naval and military hospitals. On Mount Wise, which was formerly defended by a battery (now a naval signalling station), stands the military residence, or Government House, occupied by the commander of the Plymouth Coast Defences; and near at hand is the principal naval residence, the naval commander-in-chief's house. The prospect from Mount Wise over the Hamoaze to Mount Edgecumbe on the opposite shore is one of the finest in the south of England. The most noteworthy feature of Devonport, however, is the royal dockyard, originally established by William III. in 1689 and until 1824 known as Plymouth Dock. It is situated within the old town boundary and contains four docks. To this in 1853 was added Keyham steamyard, situated higher up the Hamoaze beyond the old boundary and connected with the Devonport yard by a tunnel. In 1896 further extensions were begun at the Keyham yard, which became known as Devonport North yard. Before these were begun the yard comprised two basins, the northern one being 9 acres and the southern 7 acres in area, and three docks, having floor-lengths of 295, 347 and 413 ft., together with iron and brass foundries, machinery shops, engineer students' shop, &c. The new extensions, opened by the Prince of Wales on the 21st of February 1907, cover a total area of 118 acres lying to the northward in front of the Naval Barracks, and involved the reclamation of 77 acres of mudflats lying below high-water mark. The scheme presented three leading features—a tidal basin, a group of three graving docks with entrance lock, and a large enclosed basin with a coaling depôt at the north end. The tidal basin, close to the old Keyham north basin, is 740 ft. long with a mean width of 590 ft., and has an area of 10 acres, the depth being 32 ft. at low water of spring tides. It affords access to two graving docks, one with a floor-length of 745 ft. and 20½ ft. of water over the sill, and

the other with a length of 741 ft. and 32 ft. of water over the sill. Each of these can be subdivided by means of an intermediate caisson, and (when unoccupied) may serve as an entrance to the closed basin. The lock which leads from the tidal to the closed basin is 730 ft. long, and if necessary can be used as a dock. The closed basin, out of which opens a third graving dock, 660 ft. long, measures 1550 ft. by 1000 ft. and has an area of 35½ acres, with a depth of 32 ft. at low-water springs; it has a direct entrance from the Hamoaze, closed by a caisson. The foundations of the walls are carried down to the rock, which in some places lies covered with mud 100 ft. or more below coping level. Compressed air is used to work the sliding caissons which close the entrances of the docks and closed basin. A ropery at Devonport produces half the hempen ropes used in the navy.

By the Reform Act of 1832 Devonport was erected into a parliamentary borough including East Stonehouse and returning two members. The ground on which it stands is for the most part the property of the St Aubyn family (Barons St Levan), whose steward holds a court leet and a court baron annually. The town is governed by a mayor, sixteen aldermen and forty-eight councillors. Area, 3044 acres.

DEVONPORT, EAST and WEST, a town of Devon county, Tasmania, situated on both sides of the mouth of the river Mersey, 193 m. by rail N.W. of Hobart. Pop. (1901), East Devonport, 673, West Devonport, 2101. There is regular communication from this port to Melbourne and Sydney, and it ranks as the third port in Tasmania. A celebrated regatta is held on the Mersey annually on New Year's day.

DEVONSHIRE, EARLS AND DUKES OF. The Devonshire title, now in the Cavendish family, had previously been held by Charles Blount (1563–1606), 8th Lord Mountjoy, great-grandson of the 4th Lord Mountjoy (d. 1534), the pupil of Erasmus; he was created earl of Devonshire in 1603 for his services in Ireland, where he became famous in subduing the rebellion between 1600 and 1603; but the title became extinct at his death. In the Cavendish line the 1st earl of Devonshire was William (d. 1626), second son of Sir William Cavendish (*q.v.*), and of Elizabeth Hardwick, who afterwards married the 6th earl of Shrewsbury. He was created earl of Devonshire in 1618 by James I., and was succeeded by William, 2nd earl (1591–1628), and the latter by his son William (1617–1684), a prominent royalist, and one of the original members of the Royal Society, who married a daughter of the 2nd earl of Salisbury.

WILLIAM CAVENDISH, 1st duke of Devonshire (1640–1707), English statesman, eldest son of the earl of Devonshire last mentioned, was born on the 25th of January 1640. After completing his education he made the tour of Europe according to the custom of young men of his rank, being accompanied on his travels by Dr Killigrew. On his return he obtained, in 1661, a seat in parliament for Derbyshire, and soon became conspicuous as one of the most determined and daring opponents of the general policy of the court. In 1678 he was one of the committee appointed to draw up articles of impeachment against the lord treasurer Danby. In 1679 he was re-elected for Derby, and made a privy councillor by Charles II.; but he soon withdrew from the board with his friend Lord Russell, when he found that the Roman Catholic interest uniformly prevailed. He carried up to the House of Lords the articles of impeachment against Lord Chief-Justice Scroggs, for his arbitrary and illegal proceedings in the court of king's bench; and when the king declared his resolution not to sign the bill for excluding the duke of York, afterwards James II., he moved in the House of Commons that a bill might be brought in for the association of all his majesty's Protestant subjects. He also openly denounced the king's counsellors, and voted for an address to remove them. He appeared in defence of Lord Russell at his trial, at a time when it was scarcely more criminal to be an accomplice than a witness. After the condemnation he gave the utmost possible proof of his attachment by offering to exchange clothes with Lord Russell in the prison, remain in his place, and so allow him to effect his escape. In November 1684 he succeeded to the earldom on the death of his father. He opposed arbitrary government under James II. with the same consistency and high spirit as during the previous reign. He was withdrawn from public life for a time, however, in consequence of a hasty and imprudent act of which his enemies knew how to avail themselves. Fancying that he had received an insulting look in the presence chamber from Colonel Colepepper, a swaggerer whose attendance at court the king encouraged, he immediately avenged the affront by challenging the colonel, and, on the challenge being refused, striking him with his cane. This offence was punished by a fine of £30,000, which was an enormous sum even to one of the earl's princely fortune. Not being able to pay he was imprisoned in the king's bench, from which he was released only on signing a bond for the whole amount. This was afterwards cancelled by King William. After his discharge the earl went for a time to Chatsworth, where he occupied himself with the erection of a new mansion, designed by William Talman, with decorations by Verrio, Thornhill and Grinling Gibbons. The Revolution again brought him into prominence. He was one of the seven who signed the original paper inviting the prince of Orange from Holland, and was the first nobleman who appeared in arms to receive him at his landing. He received the order of the Garter on the occasion of the coronation, and was made lord high steward of the new court. In 1690 he accompanied King William on his visit to Holland. He was created marquis of Hartington and duke of Devonshire in 1694 by William and Mary, on the same day on which the head of the house of Russell was created duke of Bedford. Thus, to quote Macaulay, "the two great houses of Russell and Cavendish, which had long been closely connected by friendship and by marriage, by common opinions, common sufferings and common triumphs, received on the same day the highest honour which it is in the power of the crown to confer." His last public service was assisting to conclude the union with Scotland, for negotiating which he and his eldest son, the marquis of Hartington, had been appointed among the commissioners by Queen Anne. He died on the 18th of August 1707, and ordered the following inscription to be put on his monument:—

Willielmus Dux Devon,
Bonorum Principum Fidelis Subditus,
Inimicus et Invisus Tyrannis.

He had married in 1661 the daughter of James, duke of Ormonde, and he was succeeded by his eldest son William as 2nd duke, and by the latter's son William as 3rd duke (viceroy of Ireland, 1737–1744). The latter's son William (1720–1764) succeeded in 1755 as 4th duke; he married the daughter and heiress of Richard Boyle, earl of Burlington and Cork, who brought Lismore Castle and the Irish estates into the family; and from November 1756 to May 1757 he was prime minister, mainly in order that Pitt, who would not then serve under the duke of Newcastle, should be in power. His son William (1748–1811), 5th duke, is memorable as the husband of the beautiful Georgiana Spencer, duchess of Devonshire (1757–1806), and of the intellectual Elizabeth Foster, duchess of Devonshire (1758–1824), both of whom Gainsborough painted. His son, William, 6th duke (1790–1858), who died unmarried, was sent on a special mission to the coronation of the tsar Nicholas at Moscow in 1826, and became famous for his expenditure on that occasion; and it was he who employed Sir Joseph Paxton at Chatsworth. The title passed in 1858 to his cousin William (1808–1891), 2nd earl of Burlington, as 7th duke, a man who, without playing a prominent part in public affairs, exercised great influence, not only by his position but by his distinguished abilities. At Cambridge in 1829 he was second wrangler, first Smith's prizeman, and eighth classic, and subsequently he became chancellor of the university.

SPENCER COMPTON CAVENDISH, 8th duke (1833–1908), born on the 23rd of July 1833, was the son of the 7th duke (then earl of Burlington) and his wife Lady Blanche Howard (sister of the earl of Carlisle). In 1854 Lord Cavendish, as he then was, took his degree at Trinity College, Cambridge; in 1856 he was attached to the special mission to Russia for the new tsar's accession; and in 1857 he was returned to parliament as Liberal member for North Lancashire. At the opening of the new parliament of 1859 the

marquis of Hartington (as he had now become) moved the amendment to the address which overthrew the government of Lord Derby. In 1863 he became first a lord of the admiralty, and then under-secretary for war, and on the formation of the Russell-Gladstone administration at the death of Lord Palmerston he entered it as war secretary. He retired with his colleagues in July 1866; but upon Mr Gladstone's return to power in 1868 he became postmaster-general, an office which he exchanged in 1871 for that of secretary for Ireland. When Mr Gladstone, after his defeat and resignation in 1874, temporarily withdrew from the leadership of the Liberal party in January 1875, Lord Hartington was chosen Liberal leader in the House of Commons, Lord Granville being leader in the Lords. Mr W. E. Forster, who had taken a much more prominent part in public life, was the only other possible nominee, but he declined to stand. Lord Hartington's rank no doubt told in his favour, and Mr Forster's education bill had offended the Nonconformist members, who would probably have withheld their support. Lord Hartington's prudent management in difficult circumstances laid his followers under great obligations, since not only was the opposite party in the ascendant, but his own former chief was indulging in the freedom of independence. After the complete defeat of the Conservatives in the general election of 1880, a large proportion of the party would have rejoiced if Lord Hartington could have taken the Premiership instead of Mr Gladstone, and the queen, in strict conformity with constitutional usage (though Gladstone himself thought Lord Granville should have had the preference), sent for him as leader of the Opposition. Mr Gladstone, however, was clearly master of the situation: no cabinet could be formed without him, nor could he reasonably be expected to accept a subordinate post. Lord Hartington, therefore, gracefully abdicated the leadership, and became secretary of state for India, from which office, in December 1882, he passed to the war office. His administration was memorable for the expeditions of General Gordon and Lord Wolseley to Khartum, and a considerable number of the Conservative party long held him chiefly responsible for the "betrayal of Gordon." His lethargic manner, apart from his position as war minister, helped to associate him in their minds with a disaster which emphasized the fact that the government acted "too late"; but Gladstone and Lord Granville were no less responsible than he. In June 1885 he resigned along with his colleagues, and in December was elected for the Rossendale Division of Lancashire, created by the new reform bill. Immediately afterwards the great political opportunity of Lord Hartington's life came to him in Mr Gladstone's conversion to home rule for Ireland. Lord Hartington's refusal to follow his leader in this course inevitably made him the chief of the new Liberal Unionist party, composed of a large and influential section of the old Liberals. In this capacity he moved the first resolution at the famous public meeting at the opera house, and also, in the House of Commons, moved the rejection of Mr Gladstone's Bill on the second reading. During the memorable electoral contest which followed, no election excited more interest than Lord Hartington's for the Rossendale division, where he was returned by a majority of nearly 1500 votes. In the new parliament he held a position much resembling that which Sir Robert Peel had occupied after his fall from power, the leader of a small, compact party, the standing and ability of whose members were out of all proportion to their numbers, generally esteemed and trusted beyond any other man in the country, yet in his own opinion forbidden to think of office. Lord Salisbury's offers to serve under him as prime minister (both after the general election, and again when Lord Randolph Churchill resigned) were declined, and Lord Hartington continued to discharge the delicate duties of the leader of a middle party with no less judgment than he had shown when leading the Liberals during the interregnum of 1875–1880. It was not until 1895, when the differences between Conservatives and Liberal Unionists had become almost obliterated by changed circumstances, and the habit of acting together, that the duke of Devonshire, as he had become by the death of his father in 1891, consented to enter Lord Salisbury's third ministry as president of the council. The duke thus was the nominal representative of education in the cabinet at a time when educational questions were rapidly becoming of great importance; and his own technical knowledge of this difficult and intricate question being admittedly superficial, a good deal of criticism from time to time resulted. He had however by this time an established position in public life, and a reputation for weight of character, which procured for him universal respect and confidence, and exempted him from bitter attack, even from his most determined political opponents. Wealth and rank combined with character to place him in a measure above party; and his succession to his father as chancellor of the university of Cambridge in 1892 indicated his eminence in the life of the country. In the same year he had married the widow of the 7th duke of Manchester.

He continued to hold the office of lord president of the council till the 3rd of October 1903, when he resigned on account of differences with Mr Balfour (*q.v.*) over the latter's attitude towards free trade. As Mr Chamberlain had retired from the cabinet, and the duke had not thought it necessary to join Lord George Hamilton and Mr Ritchie in resigning a fortnight earlier, the defection was unanticipated and was sharply criticized by Mr Balfour, who, in the rearrangement of his ministry, had only just appointed the duke's nephew and heir, Mr Victor Cavendish, to be secretary to the treasury. But the duke had come to the conclusion that while he himself was substantially a free-trader,[1] Mr Balfour did not mean the same thing by the term. He necessarily became the leader of the Free Trade Unionists who were neither Balfourites nor Chamberlainites, and his weight was thrown into the scale against any association of Unionism with the constructive policy of tariff reform, which he identified with sheer Protection. A struggle at once began within the Liberal Unionist organization between those who followed the duke and those who followed Mr Chamberlain (*q.v.*); but the latter were in the majority and a reorganization in the Liberal Unionist Association took place, the Unionist free-traders seceding and becoming a separate body. The duke then became president of the new organizations, the Unionist Free Food League and the Unionist Free Trade Club. In the subsequent developments the duke played a dignified but somewhat silent part, and the Unionist rout in 1906 was not unaffected by his open hostility to any taint of compromise with the tariff reform movement. But in the autumn of 1907 his health gave way, and grave symptoms of cardiac weakness necessitated his abstaining from public effort and spending the winter abroad. He died, rather suddenly, at Cannes on the 24th of March 1908.

The head of an old and powerful family, a wealthy territorial magnate, and an Englishman with thoroughly national tastes for sport, his weighty and disinterested character made him a statesman of the first rank in his time, in spite of the absence of showy or brilliant qualities. He had no self-seeking ambitions, and on three occasions preferred not to become prime minister. Though his speeches were direct and forcible, he was not an orator, nor "clever"; and he lacked all subtlety of intellect; but he was conspicuous for solidity of mind and straightforwardness of action, and for conscientious application as an administrator, whether in his public or private life. The fact that he once yawned in the middle of a speech of his own was commonly quoted as characteristic; but he combined a great fund of common sense and knowledge of the average opinion with a patriotic sense of duty towards the state. Throughout his career he remained an old-fashioned Liberal, or rather Whig, of a type which in his later years was becoming gradually more and more rare.

There was no issue of his marriage, and he was succeeded as 9th duke by his nephew VICTOR CHRISTIAN CAVENDISH (b. 1868), who had been Liberal Unionist member for West Derbyshire since 1891, and was treasurer of the household (1900 to 1903) and

[1] His own words to Mr Balfour at the time were: "I believe that our present system of free imports is on the whole the most advantageous to the country, though I do not contend that the principles on which it rests possess any such authority or sanctity as to forbid any departure from it, for sufficient reasons."

financial secretary to the treasury (1903 to 1905); in 1892 he married a daughter of the marquess of Lansdowne, by whom he had two sons. (H. Ch.)

DEVONSHIRE (Devon), a south-western county of England, bounded N.W. and N. by the Bristol Channel, N.E. by Somerset and Dorset, S.E. and S. by the English Channel, and W. by Cornwall. The area, 2604·9 sq. m., is exceeded only by those of Yorkshire and Lincolnshire among the English counties. Nearly the whole of the surface is uneven and hilly. The county contains the highest land in England south of Derbyshire (excepting points on the south Welsh border); and the scenery, much varied, is in most parts striking and picturesque. The heather-clad uplands of Exmoor, though chiefly within the borders of Somerset, extend into North Devon, and are still the haunt of red deer, and of the small hardy ponies called after the district. Here, as on Dartmoor, the streams are rich in trout. Dartmoor, the principal physical feature of the county, is a broad and lofty expanse of moorland which rises in the southern part. Its highest point, 2039 ft., is found in the north-western portion. Its rough wastes contrast finely with the wild but wooded region which immediately surrounds the granite of which it is composed, and with the rich cultivated country lying beyond. Especially noteworthy in this fertile tract are the South Hams, a fruitful district of apple orchards, lying between the Erme and the Dart; the rich meadow-land around Crediton, in the vale of Exeter; and the red rocks near Sidmouth. Two features which lend a characteristic charm to the Devonshire landscape are the number of picturesque old cottages roofed with thatch; and the deep lanes, sunk below the common level of the ground, bordered by tall hedges, and overshadowed by an arch of boughs. The north and south coasts of the county differ much in character, but both have grand cliff and rock scenery, not surpassed by any in England or Wales, resembling the Mediterranean seaboard in its range of colour. As a rule the long combes or glens down which the rivers flow seaward are densely wooded, and the country immediately inland is of great beauty. Apart from the Tamar, which constitutes the boundary between Devon and Cornwall, and flows into the English Channel, after forming in its estuary the harbours of Devonport and Plymouth, the principal rivers rise on Dartmoor. These include the Teign, Dart, Plym and Tavy, falling into the English Channel, and the Taw flowing north towards Bideford Bay. The river Torridge, also discharging northward, receives part of its waters from Dartmoor through the Okement, but itself rises in the angle of high land near Hartland point on the north coast, and makes a wide sweep southward. The lesser Dartmoor streams are the Avon, the Erme and the Vealm, all running south. The Exe rises on Exmoor in Somersetshire; but the main part of its course is through Devonshire (where it gives name to Exeter), and it is joined on its way to the English Channel by the lesser streams of the Culm, the Creedy and the Clyst. The Otter, rising on the Blackdown Hills, also runs south, and the Axe, for part of its course, divides the counties of Devon and Dorset. These eastern streams are comparatively slow; while the rivers of Dartmoor have a shorter and more rapid course.

Geology.—The greatest area occupied by any one group of rocks in Devonshire is that covered by the Culm, a series of slates, grits and greywackes, with some impure limestones and occasional radiolarian cherts as at Codden Hill; beds of "culm," an impure variety of coal, are found at Bideford and elsewhere. This series of rocks occurs at Bampton, Exeter and Chudleigh and extends thence to the western boundary. North and south of the Culm an older series of slates, grits and limestones appears; it was considered so characteristic of the county that it was called the Devonian system (*q.v.*), the marine equivalent of the Old Red Sandstone of Hereford and Scotland. It lies in the form of a trough with its axis running east and west. In the central hollow the Culm reposes, while the northern and southern rims rise to the surface respectively north of the latitude of Barnstaple and South Molton and south of the latitude of Tavistock. These Devonian rocks have been subdivided into upper, middle and lower divisions, but the stratigraphy is difficult to follow as the beds have suffered much crumpling; fine examples of contorted strata may be seen almost anywhere on the north coast, and in the south, at Bolt Head and Start Point they have undergone severe metamorphism. Limestones are only poorly developed in the north, but in the south important masses occur, in the middle and at the base of the upper subdivisions, about Plymouth, Torquay, Brixham and between Newton Abbot and Totnes. Fossil corals abound in these limestones, which are largely quarried and when polished are known as Devonshire marbles.

On the eastern side of the county is found an entirely different set of rocks which cover the older series and dip away from them gently towards the east. The lower and most westerly situated members of the younger rocks is a series of breccias, conglomerates, sandstones and marls which are probably of lower Bunter age, but by some geologists have been classed as Permian. These red rocks are beautifully exposed on the coast by Dawlish and Teignmouth, and they extend inland, producing a red soil, past Exeter and Tiverton. A long narrow strip of the same formation reaches out westward on the top of the Culm as far as Jacobstow. Farther east, the Bunter pebble beds are represented by the well-known pebble deposit of Budleigh Salterton, whence they are traceable inland towards Rockbeare. These are succeeded by the Keuper marls and sandstones, well exposed at Sidmouth, where the upper Greensand plateau is clearly seen to overlie them. The Greensand covers all the high ground northward from Sidmouth as far as the Blackdown Hills. At Beer Head and Axmouth the Chalk is seen, and at the latter place is a famous landslip on the coast, caused by the springs which issue from the Greensand below the Chalk. The Lower Chalk at Beer has been mined for building stone and was formerly in considerable demand. At the extreme east of the county, Rhaetic and Lias beds make their appearance, the former with a "bone" bed bearing the remains of saurians and fish.

Dartmoor is a mass of granite that was intruded into the Culm and Devonian strata in post-Carboniferous times and subsequently exposed by denudation. Evidences of Devonian volcanic activity are abundant in the masses of diabase, dolerite, &c., at Bradford and Trusham, south of Exeter, around Plymouth and at Ashprington. Perhaps the most interesting is the Carboniferous volcano of Brent Tor near Tavistock. An Eocene deposit, the product of the denudation of the Dartmoor Hills, lies in a small basin at Bovey Tracey (see Bovey Beds); it yields beds of lignite and valuable clays.

Raised beaches occur at Hope's Nose and the Thatcher Stone near Torquay and at other points, and a submerged forest lies in the bay south of the same place. The caves and fissures in the Devonian limestone at Kent's Hole near Torquay, Brixham and Oreston are famous for the remains of extinct mammals; bones of the elephant, rhinoceros, bear and hyaena have been found as well as flint implements of early man.

Minerals.—Silver-lead was formerly worked at Combe Martin near the north coast, and elsewhere. Tin has been worked on Dartmoor (in stream works) from an unknown period. Copper was not much worked before the end of the 18th century. Tin occurs in the granite of Dartmoor, and along its borders, but rather where the Devonian than where the Carboniferous rocks border the granite. It is found most plentifully in the district which surrounds Tavistock, which, for tin and other ores, is in effect the great mining district of the county. Here, about 4 m. from Tavistock, are the Devon Great Consols mines, which from 1843 to 1871 were among the richest copper mines in the world, and by far the largest and most profitable in the kingdom. The divided profits during this period amounted to £1,192,960. But the mining interests of Devonshire are affected by the same causes, and in the same way, as those of Cornwall. The quantity of ore has greatly diminished, and the cost of raising it from the deep mines prevents competition with foreign markets. In many mines tin underlies the general depth of the copper, and is worked when the latter has been exhausted. The mineral products of the Tavistock district are various, and besides tin and copper, ores of zinc and iron are largely distributed. Great quantities of refined arsenic have been produced at the Devon Great Consols mine, by elimination from the iron pyrites contained in the various lodes. Manganese occurs in the neighbourhood of Exeter, in the valley of the Teign and in N. Devon; but the most profitable mines, which are shallow, are, like those of tin and copper, in the Tavistock district.

The other mineral productions of the county consist of marbles, building stones, slates and potters' clay. Among building stones, the granite of Dartmoor holds the foremost place. It is much quarried near Princetown, near Moreton Hampstead on the N.E. of Dartmoor and elsewhere. The annual export is considerable. Hard traps, which occur in many places, are also much used, as are the limestones of Buckfastleigh and of Plymouth. The Roborough stone, used from an early period in Devonshire churches, is found near Tavistock, and is a hard, porphyritic elvan, taking a fine polish. Excellent roofing slates occur in the Devonian series round the southern part of Dartmoor. The chief quarries are near Ashburton and Plymouth (Cann quarry). Potters' clay is worked at King's Teignton, whence it is largely exported; at Bovey Tracey; and at Watcombe near Torquay. The Watcombe clay is of the finest quality. China clay or kaolin is found on the southern side of Dartmoor, at Lee Moor, and near Trowlesworthy. There is a large deposit of umber close to Ashburton.

Climate and Agriculture.—The climate varies greatly in different parts of the county, but everywhere it is more humid

than that of the eastern or south-eastern parts of England. The mean annual temperature somewhat exceeds that of the midlands, but the average summer heat is rather less than that of the southern counties to the east. The air of the Dartmoor highlands is sharp and bracing. Mists are frequent, and snow often lies long. On the south coast frost is little known, and many half hardy plants, such as hydrangeas, myrtles, geraniums and heliotropes, live through the winter without protection. The climate of Sidmouth, Teignmouth, Torquay and other watering places on this coast is very equable, the mean temperature in January being 43·6° at Plymouth. The north coast, exposed to the storms and swell of the Atlantic, is more bracing; although there also, in the more sheltered nooks (as at Combe Martin), myrtles of great size and age flower freely, and produce their annual crop of berries.

Rather less than three-quarters of the total area of the county is under cultivation; the cultivated area falling a little below the average of the English counties. There are, however, about 160,000 acres of hill pasture in addition to the area in permanent pasture, which is more than one-half that of the cultivated area. The Devon breed of cattle is well adapted both for fattening and for dairy purposes; while sheep are kept in great numbers on the hill pastures. Devonshire is one of the chief cattle-farming and sheep-farming counties. It is specially famous for two products of the dairy—the clotted cream to which it gives its name, and junket. Of the area under grain crops, oats occupy about three times the acreage under wheat or barley. The bulk of the acreage under green crops is occupied by turnips, swedes and mangold. Orchards occupy a large acreage, and consist chiefly of apple-trees, nearly every farm maintaining one for the manufacture of cider.

Fisheries.—Though the fisheries of Devon are less valuable than those of Cornwall, large quantities of the pilchard and herrings caught in Cornish waters are landed at Plymouth. Much of the fishing is carried on within the three-mile limit; and it may be asserted that trawling is the main feature of the Devonshire industry, whereas seining and driving characterize that of Cornwall. Pilchard, cod, sprats, brill, plaice, soles, turbot, shrimps, lobsters, oysters and mussels are met with, besides herring and mackerel, which are fairly plentiful. After Plymouth, the principal fishing station is at Brixham, but there are lesser stations in every bay and estuary.

Other Industries.—The principal industrial works in the county are the various Government establishments at Plymouth and Devonport. Among other industries may be noted the lace-works at Tiverton; the manufacture of pillow-lace for which Honiton and its neighbourhood has long been famous; and the potteries and terra-cotta works of Bovey Tracey and Watcombe. Woollen goods and serges are made at Buckfastleigh and Ashburton, and boots and shoes at Crediton. Convict labour is employed in the direction of agriculture, quarrying, &c., in the great prison of Dartmoor.

Communications.—The main line of the Great Western railway, entering the county in the east from Taunton, runs to Exeter, skirts the coast as far as Teignmouth, and continues a short distance inland by Newton Abbot to Plymouth, after which it crosses the estuary of the Tamar by a great bridge to Saltash in Cornwall. Branches serve Torquay and other seaside resorts of the south coast; and among other branches are those from Taunton to Barnstaple and from Plymouth northward to Tavistock and Launceston. The main line of the London & South-Western railway between Exeter and Plymouth skirts the north and west of Dartmoor by Okehampton and Tavistock. A branch from Yeoford serves Barnstaple, Ilfracombe, Bideford and Torrington, while the Lynton & Barnstaple and the Bideford, Westward Ho & Appledore lines serve the districts indicated by their names. The branch line to Princetown from the Plymouth-Tavistock line of the Great Western company in part follows the line of a very early railway—that constructed to connect Plymouth with the Dartmoor prison in 1819–1825, which was worked with horse cars. The only waterways of any importance are the Tamar, which is navigable up to Gunnislake (3 m. S.W. of Tavistock), and the Exeter ship canal, noteworthy as one of the oldest in England, for it was originally cut in the reign of Elizabeth.

Population and Administration.—The area of the ancient county is 1,667,154 acres, with a population in 1891 of 631,808, and 1901 of 661,314. The area of the administrative county is 1,671,168 acres. The county contains 33 hundreds. The municipal boroughs are Barnstaple (pop. 14,137), Bideford (8754), Dartmouth (6579), Devonport, a county borough (70,437), Exeter, a city and county borough (47,185), Torrington, officially Great Torrington (3241), Honiton (3271), Okehampton (2569), Plymouth, a county borough (107,636), South Molton (2848), Tiverton (10,382), Torquay (33,625), Totnes (4035). The other urban districts are Ashburton (2628), Bampton (1657), Brixham (8092), Buckfastleigh (2520), Budleigh Salterton (1885), Crediton (3974), Dawlish (4003), East Stonehouse (15,111), Exmouth (10,485), Heavitree (7529), Holsworthy (1371), Ilfracombe (8557), Ivybridge (1575), Kingsbridge (3025), Lynton (1641), Newton Abbot (12,517), Northam (5355), Ottery St Mary (3495), Paignton (8385), Salcombe (1710), Seaton (1325), Sidmouth (4201), Tavistock (4728), Teignmouth (8636). The county is in the western circuit, and assizes are held at Exeter. It has one court of quarter sessions, and is divided into twenty-four petty sessional divisions. The boroughs of Barnstaple, Bideford, Devonport, Exeter, Plymouth, South Molton, and Tiverton have separate commissions of the peace and courts of quarter sessions, and those of Dartmouth, Great Torrington, Torquay and Totnes have commissions of the peace only. There are 461 civil parishes. Devonshire is in the diocese of Exeter, with the exception of small parts in those of Salisbury and Truro; and there are 516 ecclesiastical parishes or districts wholly or in part within the county. The parliamentary divisions are the Eastern or Honiton, North-eastern or Tiverton, Northern or South Molton, North-western or Barnstaple, Western or Tavistock, Southern or Totnes, Torquay, and Mid or Ashburton, each returning one member; and the county also contains the parliamentary boroughs of Devonport and Plymouth, each returning two members, and that of Exeter, returning one member.

History.—The Saxon conquest of Devonshire must have begun some time before the 8th century, for in 700 there existed at Exeter a famous Saxon school. By this time, however, the Saxons had become Christians, and established their supremacy, not by destructive inroads, but by a gradual process of colonization, settling among the native Welsh and allowing them to hold lands under equal laws. The final incorporation of the district which is now Devonshire with the kingdom of Wessex must have taken place about 766, but the county, and even Exeter, remained partly Welsh until the time of Æthelstan. At the beginning of the 9th century Wessex was divided into definite *pagi*, probably corresponding to the later shires, and the Saxon Chronicle mentions Devonshire by name in 823, when a battle was fought between the Welsh in Cornwall and the people of Devonshire at Camelford. During the Danish invasions of the 9th century aldermen of Devon are frequently mentioned. In 851 the invaders were defeated by the fyrd and aldermen of Devon, and in 878, when the Danes under Hubba were harrying the coast with a squadron of twenty-three ships, they were again defeated with great slaughter by the fyrd. The modern hundreds of Devonshire correspond in position very nearly with those given in the Domesday Survey, though the names have in many cases been changed, owing generally to alterations in their places of meeting. The hundred of Bampton formerly included estates west of the Exe, now transferred to the hundred of Witheridge. Ten of the modern hundreds have been formed by the union of two or more Domesday hundreds, while the Domesday hundred of Liston has had the new hundred of Tavistock severed from it since 1114. Many of the hundreds were separated by tracts of waste and forest land, of which Devonshire contained a vast extent, until in 1294 the inhabitants paid 5000 marks to have the county disafforested, with the exception only of Dartmoor and Exmoor.

Devonshire in the 7th century formed part of the vast bishopric

of Dorchester-on-Thames. In 705 it was attached to the newly created diocese of Sherborne, and in 910 Archbishop Plegmund constituted Devonshire a separate diocese, and placed the see at Crediton. About 1030 the dioceses of Devonshire and Cornwall were united, and in 1049 the see was fixed at Exeter. The archdeaconries of Exeter, Barnstaple and Totnes are all mentioned in the 12th century and formerly comprised twenty-four deaneries. The deaneries of Three Towns, Collumpton and Ottery have been created since the 16th century, while those of Tamerton, Dunkeswell, Dunsford and Plymptre have been abolished, bringing the present number to twenty-three.

At the time of the Norman invasion Devonshire showed an active hostility to Harold, and the easy submission which it rendered to the Conqueror accounts for the exceptionally large number of Englishmen who are found retaining lands after the Conquest. The many vast fiefs held by Norman barons were known as honours, chief among them being Plympton, Okehampton, Barnstaple, Harberton and Totnes. The honour of Plympton was bestowed in the 12th century on the Redvers family, together with the earldom of Devon; in the 13th century it passed to the Courtenay family, who had already become possessed of the honour of Okehampton, and who in 1335 obtained the earldom. The dukedom of Exeter was bestowed in the 14th century on the Holland family, which became extinct in the reign of Edward IV. The ancestors of Sir Walter Raleigh, who was born at Budleigh, had long held considerable estates in the county.

Devonshire had an independent sheriff, the appointment being at first hereditary, but afterwards held for one year only. In 1320 complaint was made that all the hundreds of Devonshire were in the hands of the great lords, who did not appoint a sufficiency of bailiffs for their proper government. The miners of Devon had independent courts, known as stannary courts, for the regulation of mining affairs, the four stannary towns being Tavistock, Ashburton, Chagford, and Plympton. The ancient miners' parliament was held in the open air at Crockern's Tor.

The castles of Exeter and Plympton were held against Stephen by Baldwin de Redvers, and in the 14th and 15th centuries the French made frequent attacks on the Devonshire coast, being repulsed in 1404 by the people of Dartmouth. In the Wars of the Roses the county was much divided, and frequent skirmishes took place between the earl of Devon and Lord Bonville, the respective champions of the Lancastrian and Yorkist parties. Great disturbances in the county followed the Reformation of the 16th century and in 1549 a priest was compelled to say mass at Sampford Courtney. On the outbreak of the Civil War the county as a whole favoured the parliament, but the prevailing desire was for peace, and in 1643 a treaty for the cessation of hostilities in Devonshire and Cornwall was agreed upon. Skirmishes, however, continued until the capture of Dartmouth and Exeter in 1646 put an end to the struggle. In 1688 the prince of Orange landed at Torbay and was entertained for several days at Ford and at Exeter.

The tin mines of Devon have been worked from time immemorial, and in the 14th century mines of tin, copper, lead, gold and silver are mentioned. Agriculturally the county was always poor, and before the disafforestation rendered especially so through the ravages committed by the herds of wild deer. At the time of the Domesday Survey the salt industry was important, and there were ninety-nine mills in the county and thirteen fisheries. From an early period the chief manufacture was that of woollen cloth, and a statute 4 Ed. IV. permitted the manufacture of cloths of a distinct make in certain parts of Devonshire. About 1505 Anthony Bonvis, an Italian, introduced an improved method of spinning into the county, and cider-making is mentioned in the 16th century. In 1680 the lace industry was already flourishing at Colyton and Ottery St Mary, and flax, hemp and malt were largely produced in the 17th and 18th centuries.

Devonshire returned two members to parliament in 1290, and in 1295 Barnstaple, Exeter, Plympton, Tavistock, Torrington and Totnes were also represented. In 1831 the county with its boroughs returned a total of twenty-six members, but under the Reform Act of 1832 it returned four members in two divisions, and with ten boroughs was represented by a total of eighteen members. Under the act of 1868 the county returned six members in three divisions, and four of the boroughs were disfranchised, making a total of seventeen members.

Antiquities.—In primeval antiquities Devonshire is not so rich as Cornwall; but Dartmoor abounds in remains of the highest interest, the most peculiar of which are the long parallel alignments of upright stones, which, on a small scale, resemble those of Carnac in Brittany. On Dartmoor the lines are invariably straight, and are found in direct connexion with cairns, and with circles which are probably sepulchral. These stone avenues are very numerous. Of the so-called sacred circles the best examples are the "Longstones" on Scorhill Down, and the "Grey Wethers" under Sittaford Tor. By far the finest cromlech is the "Spinster's Rock" at Drewsteignton, a three-pillared cromlech which may well be compared with those of Cornwall. There are numerous menhirs or single upright stones; a large dolmen or holed stone lies in the bed of the Teign, near the Scorhill circle; and rock basins occur on the summit of nearly every tor on Dartmoor (the largest are on Kestor, and on Heltor, above the Teign). It is, however, tolerably evident that these have been produced by the gradual disintegration of the granite, and that the dolmen in the Teign is due to the action of the river. Clusters of hut foundations, circular, and formed of rude granite blocks, are frequent; the best example of such a primitive village is at Batworthy, near Chagford; the type resembles that of East Cornwall. Walled enclosures, or pounds, occur in many places; Grimspound is the most remarkable. Boundary lines, also called trackways, run across Dartmoor in many directions; and the rude bridges, formed of great slabs of granite, deserve notice. All these remains are on Dartmoor. Scattered over the county are numerous large hill castles and camps,—all earthworks, and all apparently of the British period. Roman relics have been found from time to time at Exeter (*Isca Damnoniorum*), the only large Roman station in the county.

The churches are for the most part of the Perpendicular period, dating from the middle of the 14th to the end of the 15th century. Exeter cathedral is of course an exception, the whole (except the Norman towers) being very beautiful Decorated work. The special features of Devonshire churches, however, are the richly carved pulpits and chancel screens of wood, in which this county exceeded every other in England, with the exception of Norfolk and Suffolk. The designs are rich and varied, and the skill displayed often very great. Granite crosses are frequent, the finest and earliest being that of Coplestone, near Crediton. Monastic remains are scanty; the principal are those at Tor, Buckfast, Tavistock and Buckland Abbeys. Among domestic buildings the houses of Wear Gifford, Bradley and Dartington of the 15th century; Bradfield and Holcombe Rogus (Elizabethan), and Forde (Jacobean), deserve notice. The ruined castles of Okehampton (Edward I.), Exeter, with its vast British earthworks, Berry Pomeroy (Henry III., with ruins of a large Tudor mansion), Totnes (Henry III.) and Compton (early 15th century), are all interesting and picturesque.

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DEVRIENT, the name of a family of German actors.

LUDWIG DEVRIENT (1784–1832), born in Berlin on the 15th of December 1784, was the son of a silk merchant. He was

apprenticed to an upholsterer, but, suddenly leaving his employment, joined a travelling theatrical company, and made his first appearance on the stage at Gera in 1804 as the messenger in Schiller's *Braut von Messina*. By the interest of Count Brühl, he appeared at Rudolstadt as Franz Moor in Schiller's *Räuber*, so successfully that he obtained a permanent engagement at the ducal theatre in Dessau, where he played until 1809. He then received a call to Breslau, where he remained for six years. So brilliant was his success in the title-parts of several of Shakespeare's plays, that Iffland began to fear for his own reputation; yet that great artist was generous enough to recommend the young actor as his only possible successor. On Iffland's death Devrient was summoned to Berlin, where he was for fifteen years the popular idol. He died there on the 30th of December 1832. Ludwig Devrient was equally great in comedy and tragedy. Falstaff, Franz Moor, Shylock, King Lear and Richard II. were among his best parts. Karl von Holtei in his *Reminiscences* has given a graphic picture of him and the "demoniac fascination" of his acting.

See Z. Funck, *Aus dem Leben zweier Schauspieler, Ifflands und Devrients* (Leipzig, 1838); H. Smidt in *Devrient-Novellen* (3rd ed., Berlin, 1882); R. Springer in the novel *Devrient und Hoffmann* (Berlin, 1873), and Eduard Devrient's *Geschichte der deutschen Schauspielkunst* (Leipzig, 1861).

Three of the nephews of Ludwig Devrient, sons of his brother, a merchant, were also connected with the stage. KARL AUGUST DEVRIENT (1797–1872) was born at Berlin on the 5th of April 1797. After being for a short time in business, he entered a cavalry regiment as volunteer and fought at Waterloo. He then joined the stage, making his first appearance on the stage in 1819 at Brunswick. In 1821 he received an engagement at the court theatre in Dresden, where, in 1823, he married Wilhelmine Schröder (see SCHRÖDER-DEVRIENT). In 1835 he joined the company at Karlsruhe, and in 1839 that at Hanover. His best parts were Wallenstein and King Lear. He died on the 5th of April 1872. His brother PHILIPP EDUARD DEVRIENT (1801–1877), born at Berlin on the 11th of August 1801, was for a time an opera singer. Turning his attention to theatrical management, he was from 1844 to 1846 director of the court theatre in Dresden. Appointed to Karlsruhe in 1852, he began a thorough reorganization of the theatre, and in the course of seventeen years of assiduous labour, not only raised it to a high position, but enriched its repertory by many noteworthy librettos, among which *Die Gunst des Augenblicks* and *Verirrungen* are the best known. But his chief work is his history of the German stage—*Geschichte der deutschen Schauspielkunst* (Leipzig, 1848–1874). He died on the 4th of October 1877. A complete edition of his works—*Dramatische und dramaturgische Schriften*—was published in ten volumes (Leipzig, 1846–1873).

The youngest and the most famous of the three nephews of Ludwig Devrient was GUSTAV EMIL DEVRIENT (1803–1872), born in Berlin on the 4th of September 1803. He made his first appearance on the stage in 1821, at Brunswick, as Raoul in Schiller's *Jungfrau von Orleans*. After a short engagement in Leipzig, he received in 1829 a call to Hamburg, but after two years accepted a permanent appointment at the court theatre in Dresden, to which he belonged until his retirement in 1868. His chief characters were Hamlet, Uriel Acosta (in Karl Gutzkow's play), Marquis Posa (in Schiller's *Don Carlos*), and Goethe's Torquato Tasso. He acted several times in London, where his Hamlet was considered finer than Kemble's or Edmund Kean's. He died on the 7th of August 1872.

OTTO DEVRIENT (1838–1894), another actor, born in Berlin on the 3rd of October 1838, was the son of Philipp Eduard Devrient. He joined the stage in 1856 at Karlsruhe, and acted successively in Stuttgart, Berlin and Leipzig, until he received a fixed appointment at Karlsruhe, in 1863. In 1873 he became stage manager at Weimar, where he gained great praise for his *mise en scène* of Goethe's *Faust*. After being manager of the theatres in Mannheim and Frankfort he retired to Jena, where in 1883 he was given the honorary degree of doctor of philosophy. In 1884 he was appointed director of the court theatre in Oldenburg, and in 1889 director of dramatic plays in Berlin. He died at Stettin on the 23rd of June 1894.

DEW. The word "dew" (O.E. *deaw*; cf. Ger. *Tau*) is a very ancient one and its meaning must therefore be defined on historical principles. According to the *New English Dictionary*, it means "the moisture deposited in minute drops upon any cool surface by condensation of the vapour of the atmosphere; formed after a hot day, during or towards night and plentiful in the early morning." Huxley in his *Physiography* makes the addition "without production of mist." The formation of mist is not necessary for the formation of dew, nor does it necessarily prevent it. If the deposit of moisture is in the form of ice instead of water it is called hoarfrost. The researches of Aitken suggest that the words "by condensation of the vapour in the atmosphere" might be omitted from the definition. He has given reasons for believing that the large dewdrops on the leaves of plants, the most characteristic of all the phenomena of dew, are to be accounted for, in large measure at least, by the exuding of drops of water from the plant through the pores of the leaves themselves. The formation of dewdrops in such cases is the continuation of the irrigation process of the plant for supplying the leaves with water from the soil. The process is set up in full vigour in the daytime to maintain tolerable thermal conditions at the surface of the leaf in the hot sun, and continued after the sun has gone.

On the other hand, the most typical physical experiment illustrating the formation of dew is the production of a deposit of moisture, in minute drops, upon the exterior surface of a glass or polished metal vessel by the cooling of a liquid contained in the vessel. If the liquid is water, it can be cooled by pieces of ice; if volatile like ether, by bubbling air through it. No deposit is formed by this process until the temperature is reduced to a point which, from that circumstance, has received a special name, although it depends upon the state of the air round the vessel. So generally accepted is the physical analogy between the natural formation of dew and its artificial production in the manner described, that the point below which the temperature of a surface must be reduced in order to obtain the deposit is known as the "dew-point."

In the view of physicists the dew-point is the temperature at which, *by being cooled without change of pressure*, the air becomes saturated with water vapour, not on account of any increase of supply of that compound, but by the diminution of the capacity of the air for holding it in the gaseous condition. Thus, when the dew-point temperature has been determined, the pressure of water vapour in the atmosphere at the time of the deposit is given by reference to a table of saturation pressures of water vapour at different temperatures. As it is a well-established proposition that the pressure of the water vapour in the air does not vary while the air is being cooled without change of its total external pressure, the saturation pressure at the dew-point gives the pressure of water vapour in the air when the cooling commenced. Thus the artificial formation of dew and consequent determination of the dew-point is a recognized method of measuring the pressure, and thence the amount of water vapour in the atmosphere. The dew-point method is indeed in some ways a fundamental method of hygrometry.

The dew-point is a matter of really vital consequence in the question of the oppressiveness of the atmosphere or its reverse. So long as the dew-point is low, high temperature does not matter, but when the dew-point begins to approach the normal temperature of the human body the atmosphere becomes insupportable.

The physical explanation of the formation of dew consists practically in determining the process or processes by which leaves, blades of grass, stones, and other objects in the open air upon which dew may be observed, become cooled "below the dew-point."

Formerly, from the time of Aristotle at least, dew was supposed to "fall." That view of the process was not extinct at the time of Wordsworth and poets might even now use the figure without reproach. To Dr Charles Wells of London belongs the credit of bringing to a focus the ideas which originated with the study of

radiation at the beginning of the 19th century, and which are expressed by saying that the cooling necessary to produce dew on exposed surfaces is to be attributed to the radiation from the surfaces to a clear sky. He gave an account of the theory of automatic cooling by rediation, which has found a place in all text-books of physics, in his first *Essay on Dew* published in 1818. The theory is supported in that and in a second essay by a number of well-planned observations, and the essays are indeed models of scientific method. The process of the formation of dew as represented by Wells is a simple one. It starts from the point of view that all bodies are constantly radiating heat, and cool automatically unless they receive a corresponding amount of heat from other bodies by radiation or conduction. Good radiators, which are at the same time bad conductors of heat, such as blades of grass, lose heat rapidly on a clear night by radiation to the sky and become cooled below the dew-point of the atmosphere.

The question was very fully studied by Melloni and others, but little more was added to the explanation given by Wells until 1885, when John Aitken of Falkirk called attention to the question whether the water of dewdrops on plants or stones came from the air or the earth, and described a number of experiments to show that under the conditions of observation in Scotland, it was the earth from which the moisture was probably obtained, either by the operation of the vascular system of plants in the formation of exuded dewdrops, or by evaporation and subsequent condensation in the lowest layer of the atmosphere. Some controversy was excited by the publication of Aitken's views, and it is interesting to revert to it because it illustrates a proposition which is of general application in meteorological questions, namely, that the physical processes operative in the evolution of meteorological phenomena are generally complex. It is not radiation alone that is necessary to produce dew, nor even radiation from a body which does not conduct heat. The body must be surrounded by an atmosphere so fully supplied with moisture that the dew-point can be passed by the cooling due to radiation. Thus the conditions favourable for the formation of dew are (1) a good radiating surface, (2) a still atmosphere, (3) a clear sky, (4) thermal insulation of the radiating surface, (5) warm moist ground or some other provision to produce a supply of moisture in the surface layers of air.

Aitken's contribution to the theory of dew shows that in considering the supply of moisture we must take into consideration the ground as well as the air and concern ourselves with the temperature of both. Of the five conditions mentioned, the first four may be considered necessary, but the fifth is very important for securing a copious deposit. It can hardly be maintained that no dew could form unless there were a supply of water by evaporation from warm ground, but, when such a supply is forthcoming, it is evident that in place of the limited process of condensation which deprives the air of its moisture and is therefore soon terminable, we have the process of distillation which goes on as long as conditions are maintained. This distinction is of some practical importance for it indicates the protecting power of wet soil in favour of young plants as against night frost. If distillation between the ground and the leaves is set up, the temperature of the leaves cannot fall much below the original dew-point because the supply of water for condensation is kept up; but if the compensation for loss of heat by radiation is dependent simply on the condensation of water from the atmosphere, without renewal of the supply, the dew-point will gradually get lower as the moisture is deposited and the process of cooling will go on.

In these questions we have to deal with comparatively large changes taking place within a small range of level. It is with the layer a few inches thick on either side of the surface that we are principally concerned, and for an adequate comprehension of the conditions close consideration is required. To illustrate this point reference may be made to figs. 1 and 2, which represent the condition of affairs at 10·40 P.M. on about the 20th of October 1885, according to observations by Aitken. Vertical distances represent heights in feet, while the temperatures of the air and the dew-point are represented by horizontal distances and their variations with height by the curved lines of the diagram. The line marked 0 is the ground level itself, a rather indefinite quantity when the surface is grass. The whole vertical distance represented is from 4 ft. above ground to 1 ft. below ground, and the special phenomena which we are considering take place in the layer which represents the rapid transition between the temperature of the ground 3 in. below the surface and that of the air a few inches above ground.

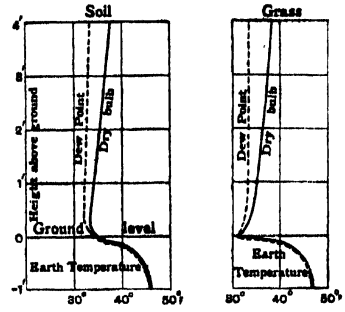

FIG. 1.

FIG. 2.

The point of interest is to determine where the dew-point curve and dry-bulb curve will cut. If they cut above the surface, mist will result; if they cut at the surface, dew will be formed. Below the surface, it may be assumed that the air is saturated with moisture and any difference in temperature of the dew-point is accompanied by distillation. It may be remarked, by the way, that such distillation between soil layers of different temperatures must be productive of the transference of large quantities of water between different levels in the soil either upward or downward according to the time of year.

These diagrams illustrate the importance of the warmth and moisture of the ground in the phenomena which have been considered. From the surface there is a continual loss of heat going on by radiation and a continual supply of warmth and moisture from below. But while the heat can escape, the moisture cannot. Thus the dry-bulb line is deflected to the left as it approaches the surface, the dew-point line to the right. Thus the effect of the moisture of the ground is to cause the lines to approach. In the case of grass, fig. 2, the deviation of the dry-bulb line to the left to form a sharp minimum of temperature at the surface is well shown. The dew-point line is also shown diverted to the left to the same point as the dry-bulb; but that could only happen if there were so copious a condensation from the atmosphere as actually to make the air drier at the surface than up above. In diagram 1, for soil, the effect on air temperature and moisture is shown; the two lines converge to cut at the surface where a dew deposit will be formed. Along the underground line there must be a gradual creeping of heat and moisture towards the surface by distillation, the more rapid the greater the temperature gradient.

The amount of dew deposited is considerable, and, in tropical countries, is sometimes sufficiently heavy to be collected by gutters and spouts, but it is not generally regarded as a large percentage of the total rainfall. Loesche estimates the amount of dew for a single night on the Loango coast at 3 mm., but the estimate seems a high one. Measurements go to show that the depth of water corresponding with the aggregate annual deposit of dew is 1 in. to 1·5 in. near London (G. Dines), 1·2 in. at Munich (Wollny), 0·3 in. at Montpellier (Crova), 1·6 in. at Tenbury, Worcestershire (Badgley).

With the question of the amount of water collected as dew, that of the maintenance of "dew ponds" is intimately associated. The name is given to certain isolated ponds on the upper levels of the chalk downs of the south of England and elsewhere. Some of these ponds are very ancient, as the title of a work on *Neolithic Dewponds* by A. J. and G. Hubbard indicates. Their name seems to imply the hypothesis that they depend upon dew and not entirely upon rain for their maintenance as a source of water supply for cattle, for which they are used. The question has been discussed a good deal, but not settled; the balance of evidence seems to be against the view that dew deposits make any important contribution to the supply of water. The construction of dew ponds is, however, still practised on traditional lines, and it is said that a new dew pond has first to be filled artificially.

It does not come into existence by the gradual accumulation of water in an impervious basin.

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For *Dew Ponds*, see Stephen Hales, *Statical Essays*, vol. i., experiment xix., pp. 52-57 (2nd ed., London, 1731); Gilbert White, *Natural History and Antiquities of Selborne*, letter xxix. (London, 1789); Dr C. Wells, *An Essay on Dew* (London, 1818, 1821 and 1866); Rev. J. C. Clutterbuck, "Prize Essay on Water Supply," *Journ. Roy. Agric. Soc.*, 2nd series, vol. i. pp. 271-287 (1865); Field and Symons, "Evaporation from the Surface of Water," *Brit. Assoc. Rep.* (1869), sect., pp. 25, 26; J. Lucas, "Hydrogeology: One of the Developments of Modern Practical Geology," *Trans. Inst. Surveyors*, vol. ix. pp. 153-232 (1877); H. P. Slade, "A Short Practical Treatise on Dew Ponds" (London, 1877); Clement Reid, "The Natural History of Isolated Ponds," *Trans. Norfolk and Norwich Naturalists' Society*, vol. v. pp. 272-286 (1892); Professor G. S. Brady, *On the Nature and Origin of Freshwater Faunas* (1899); Professor L. C. Miall, "Dew Ponds," *Reports of the British Association* (Bradford Meeting, 1900), pp. 579-585; A. J. and G. Hubbard, "Neolithic Dewponds and Cattle-Ways" (London, 1904, 1907). (W. N. S.)

DEWAN or DIWAN, an Oriental term for finance minister. The word is derived from the Arabian *diwan*, and is commonly used in India to denote a minister of the Mogul government, or in modern days the prime minister of a native state. It was in the former sense that the grant of the *dewanny* to the East India Company in 1765 became the foundation of the British empire in India.

DEWAR, SIR JAMES (1842–), British chemist and physicist, was born at Kincardine-on-Forth, Scotland, on the 20th of September 1842. He was educated at Dollar Academy and Edinburgh University, being at the latter first a pupil, and afterwards the assistant, of Lord Playfair, then professor of chemistry; he also studied under Kekulé at Ghent. In 1875 he was elected Jacksonian professor of natural experimental philosophy at Cambridge, becoming a fellow of Peterhouse, and in 1877 he succeeded Dr J. H. Gladstone as Fullerian professor of chemistry in the Royal Institution, London. He was president of the Chemical Society in 1897, and of the British Association in 1902, served on the Balfour Commission on London Water Supply (1893–1894), and as a member of the Committee on Explosives (1888–1891) invented cordite jointly with Sir Frederick Abel. His scientific work covers a wide field. Of his earlier papers, some deal with questions of organic chemistry, others with Graham's hydrogenium and its physical constants, others with high temperatures, *e.g.* the temperature of the sun and of the electric spark, others again with electro-photometry and the chemistry of the electric arc. With Professor J. G. M'Kendrick, of Glasgow, he investigated the physiological action of light, and examined the changes which take place in the electrical condition of the retina under its influence. With Professor G. D. Liveing, one of his colleagues at Cambridge, he began in 1878 a long series of spectroscopic observations, the later of which were devoted to the spectroscopic examination of various gaseous constituents separated from atmospheric air by the aid of low temperatures; and he was joined by Professor J. A. Fleming, of University College, London, in the investigation of the electrical behaviour of substances cooled to very low temperatures. His name is most widely known in connexion with his work on the liquefaction of the so-called permanent gases and his researches at temperatures approaching the zero of absolute temperature. His interest in this branch of inquiry dates back at least as far as 1874, when he discussed the "Latent Heat of Liquid Gases" before the British Association. In 1878 he devoted a Friday evening lecture at the Royal Institution to the then recent work of L. P. Cailletet and R. P. Pictet, and exhibited for the first time in Great Britain the working of the Cailletet apparatus. Six years later, in the same place, he described the researches of Z. F. Wroblewski and K. S. Olszewski, and illustrated for the first time in public the liquefaction of oxygen and air, by means of apparatus specially designed for optical projection so that the actions taking place might be visible to the audience. Soon afterwards he constructed a machine from which the liquefied gas could be drawn off through a valve for use as a cooling agent, and he showed its employment for this purpose in connexion with some researches on meteorites; about the same time he also obtained oxygen in the solid state. By 1891 he had designed and erected at the Royal Institution an apparatus which yielded liquid oxygen by the pint, and towards the end of that year he showed that both liquid oxygen and liquid ozone are strongly attracted by a magnet. About 1892 the idea occurred to him of using vacuum-jacketed vessels for the storage of liquid gases, and so efficient did this device prove in preventing the influx of external heat that it is found possible not only to preserve the liquids for comparatively long periods, but also to keep them so free from ebullition that examination of their optical properties becomes possible. He next experimented with a high-pressure hydrogen jet by which low temperatures were realized through the Thomson-Joule effect, and the successful results thus obtained led him to build at the Royal Institution the large refrigerating machine by which in 1898 hydrogen was for the first time collected in the liquid state, its solidification following in 1899. Later he investigated the gas-absorbing powers of charcoal when cooled to low temperatures, and applied them to the production of high vacua and to gas analysis (see LIQUID GASES). The Royal Society in 1894 bestowed the Rumford medal upon him for his work in the production of low temperatures, and in 1899 he became the first recipient of the Hodgkins gold medal of the Smithsonian Institution, Washington, for his contributions to our knowledge of the nature and properties of atmospheric air. In 1904 he was the first British subject to receive the Lavoisier medal of the French Academy of Sciences, and in 1906 he was the first to be awarded the Matteucci medal of the Italian Society of Sciences. He was knighted in 1904, and in 1908 he was awarded the Albert medal of the Society of Arts.

DEWAS, two native states of India, in the Malwa Political Charge of Central India, founded in the first half of the 18th century by two brothers, Punwar Mahrattas, who came into Malwa with the peshwa, Baji Rao, in 1728. Their descendants are known as the senior and junior branches of the family, and since 1841 each has ruled his own portion as a separate state, though the lands belonging to each are so intimately entangled, that even in Dewas, the capital town, the two sides of the main street are under different administrations and have different arrangements for water supply and lighting. The senior branch has an area of 446 sq. m. and a population of 62,312, while the area of the junior branch is 440 sq. m. and its population 54,904.

DEWBERRY, *Rubus caesius*, a trailing plant, allied to the bramble, of the natural order Rosaceae. It is common in woods, hedges and the borders of fields in England and other countries of Europe. The leaves have three leaflets, are hairy beneath, and of a dusky green; the flowers which appear in June and July are white, or pale rose-coloured. The fruit is large, and closely embraced by the calyx, and consists of a few drupules, which are black, with a glaucous bloom; it has an agreeable acid taste.

DEW-CLAW, the rudimentary toes, two in number, or the "false hoof" of the deer, sometimes also called the "nails." In dogs the dew-claw is the rudimentary toe or hallux (corresponding to the big toe in man) hanging loosely attached to the skin, low down on the hinder part of the leg. The origin of the word is unknown, but it has been fancifully suggested that, while the other toes touch the ground in walking, the dew-claw merely brushes the dew from the grass.

D'EWES, SIR SIMONDS, Bart. (1602–1650), English antiquarian, eldest son of Paul D'Ewes of Milden, Suffolk, and of

Cecilia, daughter and heir of Richard Simonds, of Coaxdon or Coxden, Dorsetshire, was born on the 18th of December 1602, and educated at the grammar school of Bury St Edmunds, and at St John's College, Cambridge. He had been admitted to the Middle Temple in 1611, and was called to the bar in 1623, when he immediately began his collections of material and his studies in history and antiquities. In 1626 he married Anne, daughter and heir of Sir William Clopton, of Luton's Hall in Suffolk, through whom he obtained a large addition to his already considerable fortune. On the 6th of December he was knighted. He took an active part as a strong Puritan and member of the moderate party in the opposition to the king's arbitrary government in the Long Parliament of 1640, in which he sat as member for Sudbury. On the 15th of July he was created a baronet by the king, but nevertheless adhered to the parliamentary party when war broke out, and in 1643 took the Covenant. He was one of the members expelled by Pride's Purge in 1648, and died on the 18th of April 1650. He had married secondly Elizabeth, daughter of Sir Henry Willoughby, Bart., of Risley in Derbyshire, by whom he had a son, who succeeded to his estates and title, the latter becoming extinct on the failure of male issue in 1731. D'Ewes appears to have projected a work of very ambitious scope, no less than the whole history of England based on original documents. But though excelling as a collector of materials, and as a laborious, conscientious and accurate transcriber, he had little power of generalization or construction, and died without publishing anything except an uninteresting tract, *The Primitive Practice for Preserving Truth* (1645), and some speeches. His *Journals of all the Parliaments during the Reign of Queen Elisabeth*, however, a valuable work, was published in 1682. His large collections, including transcripts from ancient records, many of the originals of which are now dispersed or destroyed, are in the Harleian collection in the British Museum. His unprinted Diaries from 1621–1624 and from 1643–1647, the latter valuable for the notes of proceedings in parliament, are often the only authority for incidents and speeches during that period, and are amusing from the glimpses the diarist affords of his own character, his good estimation of himself and his little jealousies; some are in a cipher and some in Latin.

Extracts from his *Autobiography and Correspondence* from the MSS. in the British Museum were published by J. O. Halliwell-Phillips in 1845, by Hearne in the appendix to his *Historia vitae et regni Ricardi II.* (1729), and in the *Bibliotheca topographica Britannica*, No. xv. vol. vi. (1783); and from a Diary of later date, *College Life in the Time of James I.* (1851). His Diaries have been extensively drawn upon by Forster, Gardiner, and by Sanford in his *Studies of the Great Rebellion*. Some of his speeches have been reprinted in the Harleian Miscellany and in the Somers Tracts.

DE WET, CHRISTIAN (1854–), Boer general and politician, was born on the 7th of October 1854 at Leeuwkop, Smithfield district (Orange Free State), and later resided at Dewetsdorp. He served in the first Anglo-Boer War of 1880–81 as a field cornet, and from 1881 to 1896 he lived on his farm, becoming in 1897 member of the Volksraad. He took part in the earlier battles of the Boer War of 1899 in Natal as a commandant and later, as a general, he went to serve under Cronje in the west. His first successful action was the surprise of Sanna's Post near Bloemfontein, which was followed by the victory of Reddersburg a little later. Thenceforward he came to be regarded more and more as the most formidable leader of the Boers in their guerrilla warfare. Sometimes severely handled by the British, sometimes escaping only by the narrowest margin of safety from the columns which attempted to surround him, and falling upon and annihilating isolated British posts, De Wet continued to the end of the war his successful career, striking heavily where he could do so and skilfully evading every attempt to bring him to bay. He took an active part in the peace negotiations of 1902, and at the conclusion of the war he visited Europe with the other Boer generals. While in England the generals sought, unavailingly, a modification of the terms of peace concluded at Pretoria. De Wet wrote an account of his campaigns, an English version of which appeared in November 1902 under the title *Three Years' War*. In November 1907 he was elected a member of the first parliament of the Orange River Colony and was appointed minister of agriculture. In 1908–9 he was a delegate to the Closer Union Convention.

DE WETTE, WILHELM MARTIN LEBERECHT (1780–1849), German theologian, was born on the 12th of January 1780, at Ulla, near Weimar, where his father was pastor. He was sent to the gymnasium at Weimar, then at the height of its literary glory. Here he was much influenced by intercourse with Johann Gottfried Herder, who frequently examined at the school. In 1799 he entered on his theological studies at Jena, his principal teachers being J. J. Griesbach and H. E. G. Paulus, from the latter of whom he derived his tendency to free critical inquiry. Both in methods and in results, however, he occupied an almost solitary position among German theologians. Having taken his doctor's degree, he became *privat-docent* at Jena; in 1807 professor of theology at Heidelberg, where he came under the influence of J. F. Fries (1773–1843); and in 1810 was transferred to a similar chair in the newly founded university of Berlin, where he enjoyed the friendship of Schleiermacher. He was, however, dismissed from Berlin in 1819 on account of his having written a letter of consolation to the mother of Karl Ludwig Sand, the murderer of Kotzebue. A petition in his favour presented by the senate of the university was unsuccessful, and a decree was issued not only depriving him of the chair, but banishing him from the Prussian kingdom. He retired for a time to Weimar, where he occupied his leisure in the preparation of his edition of Luther, and in writing the romance *Theodor oder die Weihe des Zweiflers* (Berlin, 1822), in which he describes the education of an evangelical pastor. During this period he made his first essay in preaching, and proved himself to be possessed of very popular gifts. But in 1822 he accepted the chair of theology in the university of Basel, which had been reorganized four years before. Though his appointment had been strongly opposed by the orthodox party, De Wette soon won for himself great influence both in the university and among the people generally. He was admitted a citizen, and became rector of the university, which owed to him much of its recovered strength, particularly in the theological faculty. He died on the 16th of June 1849.

De Wette has been described by Julius Wellhausen as "the epoch-making opener of the historical criticism of the Pentateuch." He prepared the way for the Supplement-theory. But he also made valuable contributions to other branches of theology. He had, moreover, considerable poetic faculty, and wrote a drama in three acts, entitled *Die Entsagung* (Berlin, 1823). He had an intelligent interest in art, and studied ecclesiastical music and architecture. As a Biblical critic he is sometimes classed with the destructive school, but, as Otto Pfleiderer says (*Development of Theology*, p. 102), he "occupied as free a position as the Rationalists with regard to the literal authority of the creeds of the church, but that he sought to give their due value to the religious feelings, which the Rationalists had not done, and, with a more unfettered mind towards history, to maintain the connexion of the present life of the church with the past." His works are marked by exegetical skill, unusual power of condensation and uniform fairness. Accordingly they possess value which is little affected by the progress of criticism.

The most important of his works are:—*Beiträge zur Einleitung in das Alte Testament* (2 vols., 1806–1807); *Kommentar über die Psalmen* (1811), which has passed through several editions, and is still regarded as of high authority; *Lehrbuch der hebräisch-jüdischen Archäologie* (1814); *Über Religion und Theologie* (1815); a work of great importance as showing its author's general theological position; *Lehrbuch der christlichen Dogmatik* (1813–1816); *Lehrbuch der historisch-kritischen Einleitung in die Bibel* (1817); *Christliche Sittenlehre* (1819–1821); *Einleitung in das Neue Testament* (1826); *Religion, ihr Wesen, ihre Erscheinungsform, und ihr Einfluss auf das Leben* (1827); *Das Wesen des christlichen Glaubens* (1846); and *Kurzgefasstes exegetisches Handbuch zum Neuen Testament* (1836–1848). De Wette also edited Luther's works (5 vols., 1825–1828).

See K. R. Hagenbach in Herzog's *Realencyklopädie*; G. C. F. Lücke's *W. M. L. De Wette, zur freundschaftlicher Erinnerung* (1850); and D. Schenkel's *W. M. L. De Wette und die Bedeutung seiner Theologie für unsere Zeit* (1849). Rudolf Stähelin, *De Wette nach seiner theol. Wirksamkeit und Bedeutung* (1880); F. Lichtenberger, *History of German Theology in the Nineteenth Century* (1889); Otto Pfleiderer, *Development of Theology* (1890), pp. 97 ff.; T. K. Cheyne, *Founders of Old Testament Criticism*, pp. 31 ff.

DEWEY, DAVIS RICH (1858–), American economist and statistician, was born at Burlington, Vermont, U.S.A., on the 7th of April 1858. He was educated at the university of Vermont and at Johns Hopkins University, and afterwards became professor of economics and statistics at the Massachusetts Institute of Technology. He was chairman of the state board on the question of the unemployed (1895), member of the Massachusetts commission on public, charitable and reformatory interests (1897), special expert agent on wages for the 12th census, and member of a state commission (1904) on industrial relations. He wrote an excellent *Syllabus on Political History since 1815* (1887), a *Financial History of the U.S.* (1902), and *National Problems* (1907).

DEWEY, GEORGE (1837–), American naval officer, was born at Montpelier, Vermont, on the 26th of December 1837. He studied at Norwich University, then at Norwich, Vermont, and graduated at the United States Naval Academy in 1858. He was commissioned lieutenant in April 1861, and in the Civil War served on the steamsloop "Mississippi" (1861–1863) during Farragut's passage of the forts below New Orleans in April 1862, and at Port Hudson in March 1863; took part in the fighting below Donaldsonville, Louisiana, in July 1863; and in 1864–1865 served on the steam-gunboat "Agawam" with the North Atlantic blockading squadron and took part in the attacks on Fort Fisher in December 1864 and January 1865. In March 1865 he became a lieutenant-commander. He was with the European squadron in 1866–1867; was an instructor in the United States Naval Academy in 1868–1869; was in command of the "Narragansett" in 1870–1871 and 1872–1875, being commissioned commander in 1872; was light-house inspector in 1876–1877; and was secretary of the light-house board in 1877–1882. In 1884 he became a captain; in 1889–1893 was chief of the bureau of equipment and recruiting; in 1893–1895 was a member of the light-house board; and in 1895–1897 was president of the board of inspection and survey, being promoted to the rank of commodore in February 1896. In November 1897 he was assigned, at his own request, to sea service, and sent to Asiatic waters. In April 1898, while with his fleet at Hong Kong, he was notified by cable that war had begun between the United States and Spain, and was ordered to "capture or destroy the Spanish fleet" then in Philippine waters. On the 1st of May he overwhelmingly defeated the Spanish fleet under Admiral Montojo in Manila Bay, a victory won without the loss of a man on the American ships (see SPANISH-AMERICAN WAR). Congress, in a joint resolution, tendered its thanks to Commodore Dewey, and to the officers and men under his command, and authorized "the secretary of the navy to present a sword of honor to Commodore George Dewey, and cause to be struck bronze medals commemorating the battle of Manila Bay, and to distribute such medals to the officers and men of the ships of the Asiatic squadron of the United States." He was promoted rear-admiral on the 10th of May 1898. On the 18th of August his squadron assisted in the capture of the city of Manila. After remaining in the Philippines under orders from his government to maintain control, Dewey received the rank of admiral (March 3, 1899)—that title, formerly borne only by Farragut and Porter, having been revived by act of Congress (March 2, 1899),—and returned home, arriving in New York city, where, on the 3rd of October 1899, he received a great ovation. He was a member (1899) of the Schurman Philippine Commission, and in 1899 and 1900 was spoken of as a possible Democratic candidate for the presidency. He acted as president of the Schley court of inquiry in 1901, and submitted a minority report on a few details.

DEWEY, MELVIL (1851–), American librarian, was born at Adams Center, New York, on the 10th of December 1851. He graduated in 1874 at Amherst College, where he was assistant librarian from 1874 to 1877. In 1877 he removed to Boston, where he founded and became editor of *The Library Journal*, which became an influential factor in the development of libraries in America, and in the reform of their administration. He was also one of the founders of the American Library Association, of which he was secretary from 1876 to 1891, and president in 1891 and 1893. In 1883 he became librarian of Columbia College, and in the following year founded there the School of Library Economy, the first institution for the instruction of librarians ever organized. This school, which was very successful, was removed to Albany in 1890, where it was re-established as the State Library School under his direction; from 1881 to 1906 he was director of the New York State Library and from 1888 to 1900 was secretary of the University of the State of New York, completely reorganizing the state library, which he made one of the most efficient in America, and establishing the system of state travelling libraries and picture collections. His "Decimal System of Classification" for library cataloguing, first proposed in 1876, is extensively used.

DEWING, THOMAS WILMER (1851–), American figure painter, was born in Boston, Massachusetts, on the 4th of May 1851. He was a pupil of Jules Lefebvre in Paris from 1876 to 1879; was elected a full member of the National Academy of Design in 1888; was a member of the society of Ten American Painters, New York; and received medals at the Paris Exhibition (1889), at Chicago (1893), at Buffalo (1901) and at St Louis (1904). His decorative genre pictures are notable for delicacy and finish. Among his portraits are those of Mrs Stanford White and of his own wife. Mrs Dewing (b. 1855), *née* Maria Oakey, a figure and flower painter, was a pupil of John La Farge in New York, and of Couture in Paris.

DE WINT, PETER (1784–1849), English landscape painter, of Dutch extraction, son of an English physician, was born at Stone, Staffordshire, on the 21st of January 1784. He studied art in London, and in 1809 entered the Academy schools. In 1812 he became a member of the Society of Painters in Water-colours, where he exhibited largely for many years, as well as at the Academy. He married in 1810 the sister of William Hilton, R.A. He died in London on the 30th of January 1849. De Wint's life was devoted to art; he painted admirably in oils, and he ranks as one of the chief English water-colourists. A number of his pictures are in the National Gallery and the Victoria and Albert Museum.

DE WINTER, JAN WILLEM (1750–1812), Dutch admiral, was born at Kampen, and in 1761 entered the naval service at the age of twelve years. He distinguished himself by his zeal and courage, and at the revolution of 1787 he had reached the rank of lieutenant. The overthrow of the "patriot" party forced him to fly for his safety to France. Here he threw himself heart and soul into the cause of the Revolution, and took part under Dumouriez and Pichegru in the campaigns of 1792 and 1793, and was soon promoted to the rank of brigadier-general. When Pichegru in 1795 overran Holland, De Winter returned with the French army to his native country. The states-general now utilized the experience he had gained as a naval officer by giving him the post of adjunct-general for the reorganization of the Dutch navy. In 1796 he was appointed vice-admiral and commander-in-chief of the fleet. He spared no efforts to strengthen it and improve its condition, and on the 11th of October 1797 he ventured upon an encounter off Camperdown with the British fleet under Admiral Duncan. After an obstinate struggle the Dutch were defeated, and De Winter himself was taken prisoner. He remained in England until December, when he was liberated by exchange. His conduct in the battle of Camperdown was declared by a court-martial to have nobly maintained the honour of the Dutch flag.

From 1798 to 1802 De Winter filled the post of ambassador to the French republic, and was then once more appointed commander of the fleet. He was sent with a strong squadron to the Mediterranean to repress the Tripoli piracies, and negotiated a treaty of peace with the Tripolitan government. He enjoyed the confidence of Louis Bonaparte, when king of Holland, and, after the incorporation of the Netherlands in the French empire, in an equal degree of the emperor Napoleon. By the former he was created marshal and count of Huessen, and given the command of the armed forces both by sea and land. Napoleon gave him the grand cross of the Legion of Honour and appointed him inspector-general of the northern coasts, and in 1811 he placed him at the head of the fleet he had collected at the Texel. Soon afterwards

De Winter was seized with illness and compelled to betake himself to Paris, where he died on the 2nd of June 1812. He had a splendid public funeral and was buried in the Pantheon. His heart was enclosed in an urn and placed in the Nicolaas Kerk at Kampen.

DE WITT, CORNELIUS (1623–1672), brother of John de Witt (*q.v.*), was born at Dort in 1623. In 1650 he became burgomaster of Dort and member of the states of Holland and West Friesland. He was afterwards appointed to the important post of *ruwaard* or governor of the land of Putten and bailiff of Beierland. He associated himself closely with his greater brother, the grand pensionary, and supported him throughout his career with great ability and vigour. In 1667 he was the deputy chosen by the states of Holland to accompany Admiral de Ruyter in his famous expedition to Chatham. Cornelius de Witt on this occasion distinguished himself greatly by his coolness and intrepidity. He again accompanied De Ruyter in 1672 and took an honourable part in the great naval fight at Sole Bay against the united English and French fleets. Compelled by illness to leave the fleet, he found on his return to Dort that the Orange party were in the ascendant, and he and his brother were the objects of popular suspicion and hatred. An account of his imprisonment, trial and death, is given below.

DE WITT, JOHN (1625–1672), Dutch statesman, was born at Dort, on the 24th of September 1625. He was a member of one of the old burgher-regent families of his native town. His father, Jacob de Witt, was six times burgomaster of Dort, and for many years sat as a representative of the town in the states of Holland. He was a strenuous adherent of the republican or oligarchical states-right party in opposition to the princes of the house of Orange, who represented the federal principle and had the support of the masses of the people. John was educated at Leiden, and early displayed remarkable talents, more especially in mathematics and jurisprudence. In 1645 he and his elder brother Cornelius visited France, Italy, Switzerland and England, and on his return he took up his residence at the Hague, as an advocate. In 1650 he was appointed pensionary of Dort, an office which made him the leader and spokesman of the town's deputation in the state of Holland. In this same year the states of Holland found themselves engaged in a struggle for provincial supremacy, on the question of the disbanding of troops, with the youthful prince of Orange, William II. William, with the support of the states-general and the army, seized five of the leaders of the states-right party and imprisoned them in Loevestein castle; among these was Jacob de Witt. The sudden death of William, at the moment when he had crushed opposition, led to a reaction. He left only a posthumous child, afterwards William III. of Orange, and the principles advocated by Jacob de Witt triumphed, and the authority of the states of Holland became predominant in the republic.

At this time of constitutional crisis such were the eloquence, sagacity and business talents exhibited by the youthful pensionary of Dort that on the 23rd of July 1653 he was appointed to the office of grand pensionary (*Raadpensionaris*) of Holland at the age of twenty-eight. He was re-elected in 1658, 1663 and 1668, and held office until his death in 1672. During this period of nineteen years the general conduct of public affairs and administration, and especially of foreign affairs, such was the confidence inspired by his talents and industry, was largely placed in his hands. He found in 1653 his country brought to the brink of ruin through the war with England, which had been caused by the keen commercial rivalry of the two maritime states. The Dutch were unprepared, and suffered severely through the loss of their carrying trade, and De Witt resolved to bring about peace as soon as possible. The first demands of Cromwell were impossible, for they aimed at the absorption of the two republics into a single state, but at last in the autumn of 1654 peace was concluded, by which the Dutch made large concessions and agreed to the striking of the flag to English ships in the narrow seas. The treaty included a secret article, which the states-general refused to entertain, but which De Witt succeeded in inducing the states of Holland to accept, by which the provinces of Holland pledged themselves not to elect a stadtholder or a captain-general of the union. This Act of Seclusion, as it was called, was aimed at the young prince of Orange, whose close relationship to the Stuarts made him an object of suspicion to the Protector. De Witt was personally favourable to this exclusion of William III. from his ancestral dignities, but there is no truth in the suggestion that he prompted the action of Cromwell in this matter.

The policy of De Witt after the peace of 1654 was eminently successful. He restored the finances of the state, and extended its commercial supremacy in the East Indies. In 1658–59 he sustained Denmark against Sweden, and in 1662 concluded an advantageous peace with Portugal. The accession of Charles II. to the English throne led to the rescinding of the Act of Seclusion; nevertheless De Witt steadily refused to allow the prince of Orange to be appointed stadtholder or captain-general. This led to ill-will between the English and Dutch governments, and to a renewal of the old grievances about maritime and commercial rights, and war broke out in 1665. The zeal, industry and courage displayed by the grand pensionary during the course of this fiercely contested naval struggle could scarcely have been surpassed. He himself on more than one occasion went to sea with the fleet, and inspired all with whom he came in contact by the example he set of calmness in danger, energy in action and inflexible strength of will. It was due to his exertions as an organizer and a diplomatist quite as much as to the brilliant seamanship of Admiral de Ruyter, that the terms of the treaty of peace signed at Breda (July 31, 1667), on the principle of *uti possidetis*, were so honourable to the United Provinces. A still greater triumph of diplomatic skill was the conclusion of the Triple Alliance (January 17, 1668) between the Dutch Republic, England and Sweden, which checked the attempt of Louis XIV. to take possession of the Spanish Netherlands in the name of his wife, the infanta Maria Theresa. The check, however, was but temporary, and the French king only bided his time to take vengeance for the rebuff he had suffered. Meanwhile William III. was growing to manhood, and his numerous adherents throughout the country spared no efforts to undermine the authority of De Witt, and secure for the young prince of Orange the dignities and authority of his ancestors.

In 1672 Louis XIV. suddenly declared war, and invaded the United Provinces at the head of a splendid army. Practically no resistance was possible. The unanimous voice of the people called William III. to the head of affairs, and there were violent demonstrations against John de Witt. His brother Cornelius was (July 24) arrested on a charge of conspiring against the prince. On the 4th of August John de Witt resigned the post of grand pensionary that he had held so long and with such distinction. Cornelius was put to the torture, and on the 19th of August he was sentenced to deprivation of his offices and banishment. He was confined in the Gevangenpoort, and his brother came to visit him in the prison. A vast crowd on hearing this collected outside, and finally burst into the prison, seized the two brothers and literally tore them to pieces. Their mangled remains were hung up by the feet to a lamp-post. Thus perished, by the savage act of an infuriated mob, one of the greatest statesmen of his age.

John de Witt married Wendela Bicker, daughter of an influential burgomaster of Amsterdam, in 1655, by whom he had two sons and three daughters.

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DEWLAP (from the O.E. *læppa*, a lappet, or hanging fold; the first syllable is of doubtful origin and the popular explanation that the word means "the fold which brushes the dew" is not borne out, according to the *New English Dictionary*, by the

equivalent words such as the Danish *doglaeb*, in Scandinavian languages), the loose fold of skin hanging from the neck of cattle, also applied to similar folds in the necks of other animals and fowls, as the dog, turkey, &c. The American practice of branding cattle by making a cut in the neck is known as a "dewlap brand." The skin of the neck in human beings often becomes pendulous with age, and is sometimes referred to humorously by the same name.

DEWSBURY, a market town and municipal and parliamentary borough in the West Riding of Yorkshire, England, on the river Calder, 8 m. S.S.W. of Leeds, on the Great Northern, London & North-Western, and Lancashire & Yorkshire railways. Pop. (1901) 28,060. The parish church of All Saints was for the most part rebuilt in the latter half of the 18th century; the portions still preserved of the original structure are mainly Early English. The chief industries are the making of blankets, carpets, druggets and worsted yarn; and there are iron foundries and machinery works. Coal is worked in the neighbourhood. The parliamentary borough includes the adjacent municipal borough of Batley, and returns one member. The municipal borough, incorporated in 1862, is under a mayor, 6 aldermen and 18 councillors. Area, 1471 acres. Paulinus, first archbishop of York, about the year 627 preached in the district of Dewsbury, where Edwin, king of Northumbria, whom he converted to Christianity, had a royal mansion. At Kirklees, in the parish, are remains of a Cistercian convent of the 12th century, in an extensive park, where tradition relates that Robin Hood died and was buried.

DEXIPPUS, PUBLIUS HERENNIUS (*c.* A.D. 210–273), Greek historian, statesman and general, was an hereditary priest of the Eleusinian family of the Kerykes, and held the offices of archon basileus and eponymus in Athens. When the Heruli overran Greece and captured Athens (269), Dexippus showed great personal courage and revived the spirit of patriotism among his degenerate fellow-countrymen. A statue was set up in his honour, the base of which, with an inscription recording his services, has been preserved (*Corpus Inscrr. Atticarum*, iii. No. 716). It is remarkable that the inscription is silent as to his military achievements. Photius (*cod.* 82) mentions three historical works by Dexippus, of which considerable fragments remain: (1) Τὰ μετ' Ἀλέξανδρον, an epitome of a similarly named work by Arrian; (2) Σκυθικά, a history of the wars of Rome with the Goths (or Scythians) in the 3rd century; (3) Χρονικὴ ἱστορία, a chronological history from the earliest times to the emperor Claudius Gothicus (270), frequently referred to by the writers of the Augustan history. The work was continued by Eunapius of Sardis down to 404. Photius speaks very highly of the style of Dexippus, whom he places on a level with Thucydides, an opinion by no means confirmed by the fragments (C. W. Müller, *F.H.G.* iii. 666-687).

DEXTER, HENRY MARTYN (1821–1890), American clergyman and author, was born in Plympton, Massachusetts, on the 13th of August 1821. He graduated at Yale in 1840 and at the Andover Theological Seminary in 1844; was pastor of a Congregational church in Manchester, New Hampshire, in 1844–1849, and of the Berkeley Street Congregational church, Boston, in 1849–1867; was an editor of the *Congregationalist* in 1851–1866, of the *Congregational Quarterly* in 1859–1866, and of the *Congregationalist*, with which the *Recorder* was merged, from 1867 until his death in New Bedford, Mass., on the 13th of November 1890. He was an authority on the history of Congregationalism and was lecturer on that subject at the Andover Theological Seminary in 1877–1879; he left his fine library on the Puritans in America to Yale University. Among his works are: *Congregationalism, What it is, Whence it is, How it works, Why it is better than any other Form of Church Government, and its consequent Demands* (1865), *The Church Polity of the Puritans the Polity of the New Testament* (1870), *As to Roger Williams and His "Banishment" from the Massachusetts Colony* (1876), *Congregationalism of the Last Three Hundred Years, as seen in its Literature* (1880), his most important work, *A Handbook of Congregationalism* (1880), *The True Story of John Smyth, the "Se-Baptist"* (1881), *Common Sense as to Woman Suffrage* (1885), and many reprints of pamphlets bearing on early church history in New England, especially Baptist controversies. His *The England and Holland of the Pilgrims* was completed by his son, Morton Dexter (b. 1846), and published in 1905.

DEXTER, TIMOTHY (1747–1806), American merchant, remarkable for his eccentricities, was born at Malden, Massachusetts, on the 22nd of February 1747. He acquired considerable wealth by buying up quantities of the depreciated continental currency, which was ultimately redeemed by the Federal government at par. He assumed the title of Lord Dexter and built extraordinary houses at Newburyport, Mass., and Chester, New Hampshire. He maintained a poet laureate and collected inferior pictures, besides erecting in one of his gardens some forty colossal statues carved in wood to represent famous men. A statue of himself was included in the collection, and had for an inscription "I am the first in the East, the first in the West, and the greatest philosopher in the Western World." He wrote a book entitled *Pickle for the Knowing Ones*. It was wholly without punctuation marks, and as this aroused comment, he published a second edition, at the end of which was a page displaying nothing but commas and stops, from which the readers were invited to "peper and solt it as they plese." He beat his wife for not weeping enough at the rehearsal of his funeral, which he himself carried out in a very elaborate manner. He died at Newburyport on the 26th of October 1806.

DEXTRINE (British Gum, Starch Gum, Leiocome), $(C_6H_{10}O_5)_x$, a substance produced from starch by the action of dilute acids, or by roasting it at a temperature between 170° and 240° C. It is manufactured by spraying starch with 2 % nitric acid, drying in air, and then heating to about 110°. Different modifications are known, *e.g.* amylodextrine, erythrodextrine and achroodextrine. Its name has reference to its powerful dextrorotatory action on polarized light. Pure dextrine is an insipid, odourless, white substance; commercial dextrine is sometimes yellowish, and contains burnt or unchanged starch. It dissolves in water and dilute alcohol; by strong alcohol it is precipitated from its solutions as the hydrated compound, $C_6H_{10}O_5 \cdot H_2O$. Diastase converts it eventually into maltose, $C_{12}H_{22}O_{11}$; and by boiling with dilute acids (sulphuric, hydrochloric, acetic) it is transformed into dextrose, or ordinary glucose, $C_6H_{12}O_6$. It does not ferment in contact with yeast, and does not reduce Fehling's solution. If heated with strong nitric acid it gives oxalic, and not mucic acid. Dextrine much resembles gum arabic, for which it is generally substituted. It is employed for sizing paper, for stiffening cotton goods, and for thickening colours in calico printing, also in the making of lozenges, adhesive stamps and labels, and surgical bandages.

See Otto Lueger, *Lexikon der gesamten Technik*.

DEY (an adaptation of the Turk. *dāī*, a maternal uncle), an honorary title formerly bestowed by the Turks on elderly men, and appropriated by the janissaries as the designation of their commanding officers. In Algeria the deys of the janissaries became in the 17th century rulers of that country (see Algeria: *History*). From the middle of the 16th century to the end of the 17th century the ruler of Tunisia was also called dey, a title frequently used during the same period by the sovereigns of Tripoli.

DHAMMAPĀLA, the name of one of the early disciples of the Buddha, and therefore constantly chosen as their name in religion by Buddhist novices on their entering the brotherhood. The most famous of the Bhikshus so named was the great commentator who lived in the latter half of the 5th century A.D. at the Badara Titha Vihāra, near the east coast of India, just a little south of where Madras now stands. It is to him we owe the commentaries on seven of the shorter canonical books, consisting almost entirely of verses, and also the commentary on the Netti, perhaps the oldest Pāli work outside the canon. Extracts from the latter work, and the whole of three out of the seven others, have been published by the Pāli Text Society. These works show great learning, exegetical skill and sound judgment. But as Dhammapāla confines himself rigidly either to questions of

the meaning of words, or to discussions of the ethical import of his texts, very little can be gathered from his writings of value for the social history of his time. For the right interpretation of the difficult texts on which he comments, they are indispensable. Though in all probability a Tamil by birth, he declares, in the opening lines of those of his works that have been edited, that he followed the tradition of the Great Minster at Anurādhapura in Ceylon, and the works themselves confirm this in every respect. Hsüan Tsang, the famous Chinese pilgrim, tells a quaint story of a Dhammapāla of Kāñchipura (the modern Konjevaram). He was a son of a high official, and betrothed to a daughter of the king, but escaped on the eve of the wedding feast, entered the order, and attained to reverence and distinction. It is most likely that this story, whether legendary or not (and Hsüan Tsang heard the story at Kāñchipura nearly two centuries after the date of Dhammapāla), referred to this author. But it may also refer, as Hsüan Tsang refers it, to another author of the same name. Other unpublished works, besides those mentioned above, have been ascribed to Dhammapāla, but it is very doubtful whether they are really by him.

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DHANIS, FRANCIS, BARON (1861–1909), Belgian administrator, was born in London in 1861, and passed the first fourteen years of his life at Greenock, where he received his early education. He was the son of a Belgian merchant and of an Irish lady named Maher. The name Dhanis is supposed to be a variation of D'Anvers. Having completed his education at the École Militaire he entered the Belgian army, joining the regiment of grenadiers, in which he rose to the rank of major. As soon as he reached the rank of lieutenant he volunteered for service on the Congo, and in 1887 he went out for a first term. He did so well in founding new stations north of the Congo that, when the government decided to put an end to the Arab domination on the Upper Congo, he was selected to command the chief expedition sent against the slave dealers. The campaign began in April 1892, and it was not brought to a successful conclusion till January 1894. The story of this war has been told in detail by Dr Sydney Hinde, who took part in it, in his book *The Fall of the Congo Arabs*. The principal achievements of the campaign were the captures in succession of the three Arab strongholds at Nyangwe, Kassongo and Kabambari. For his services Dhanis was raised to the rank of baron, and in 1895 was made vice-governor of the Congo State. In 1896 he took command of an expedition to the Upper Nile. His troops, largely composed of the Batetela tribes who had only been recently enlisted, and who had been irritated by the execution of some of their chiefs for indulging their cannibal proclivities, mutinied and murdered many of their white officers. Dhanis found himself confronted with a more formidable adversary than even the Arabs in these well-armed and half-disciplined mercenaries. During two years (1897–1898) he was constantly engaged in a life-and-death struggle with them. Eventually he succeeded in breaking up the several bands formed out of his mutinous soldiers. Although the incidents of the Batetela operations were less striking than those of the Arab war, many students of both think that the Belgian leader displayed the greater ability and fortitude in bringing them to a successful issue. In 1899 Baron Dhanis returned to Belgium with the honorary rank of vice governor-general. He died on the 14th of November 1909.

DHAR, a native state of India, in the Bhopawar agency, Central India. It includes many Rajput and Bhil feudatories, and has an area of 1775 sq. m. The raja is a Punwar Mahratta. The founder of the present ruling family was Anand Rao Punwar, a descendant of the great Paramara clan of Rajputs who from the 9th to the 13th century, when they were driven out by the Mahommedans, had ruled over Malwa from their capital at Dhar. In 1742 Anand Rao received Dhar as a fief from Baji Rao, the peshwa, the victory of the Mahrattas thus restoring the sovereign power to the family which seven centuries before had been expelled from this very city and country. Towards the close of the 18th and in the early part of the 19th century, the state was subject to a series of spoliations by Sindia and Holkar, and was only preserved from destruction by the talents and courage of the adoptive mother of the fifth raja. By a treaty of 1819 Dhar passed under British protection, and bound itself to act in subordinate co-operation. The state was confiscated for rebellion in 1857, but in 1860 was restored to Raja Anand Rao Punwar, then a minor, with the exception of the detached district of Bairusia, which was granted to the begum of Bhopal. Anand Rao, who received the personal title Maharaja and the K.C.S.I. in 1877, died in 1898, and was succeeded by Udaji Rao Punwar. In 1901 the population was 142,115. The state includes the ruins of Mandu, or Mandogarh, the Mahommedan capital of Malwa.

The TOWN OF DHAR is 33 m. W. of Mhow, 908 ft. above the sea. Pop. (1901) 17,792. It is picturesquely situated among lakes and trees surrounded by barren hills, and possesses, besides its old walls, many interesting buildings, Hindu and Mahommedan, some of them containing records of a great historical importance, The Lat Masjid, or Pillar Mosque, was built by Dilawar Khan in 1405 out of the remains of Jain temples. It derives its name from an iron pillar, supposed to have been originally set up at the beginning of the 13th century in commemoration of a victory, and bearing a later inscription recording the seven days' visit to the town of the emperor Akbar in 1598. The pillar, which was 43 ft. high, is now overthrown and broken. The Kamal Maula is an enclosure containing four tombs, the most notable being that of Shaikh Kamal Maulvi (Kamal-ud-din), a follower of the famous 13th-century Mussulman saint Nizam-ud-din Auliya.[1] The mosque known as Raja Bhoj's school was built out of Hindu remains in the 14th or 15th century: its name is derived from the slabs, covered with inscriptions giving rules of Sanskrit grammar, with which it is paved. On a small hill to the north of the town stands the fort, a conspicuous pile of red sandstone, said to have been built by Mahommed ben Tughlak of Delhi in the 14th century. It contains the palace of the raja. Of modern institutions may be mentioned the high school, public library, hospital, and the chapel, school and hospital of the Canadian Presbyterian mission. There is also a government opium depot for the payment of duty, the town being a considerable centre for the trade in opium as well as in grain.

The town, the name of which is usually derived from Dhara Nagari (the city of sword blades), is of great antiquity, and was made the capital of the Paramara chiefs of Malwa by Vairisinha II., who transferred his headquarters hither from Ujjain at the close of the 9th century. During the rule of the Paramara dynasty Dhar was famous throughout India as a centre of culture and learning; but, after suffering various vicissitudes, it was finally conquered by the Mussulmans at the beginning of the 14th century. At the close of the century Dilawar Khan, the builder of the Lat Masjid, who had been appointed governor in 1399, practically established his independence, his son Hoshang Shah being the first Mahommedan king of Malwa. Under this dynasty Dhar was second in importance to the capital Mandu. Subsequently, in the time of Akbar, Dhar fell under the dominion of the Moguls, in whose hands it remained till 1730, when it was conquered by the Mahrattas.

See *Imperial Gazetteer of India* (Oxford, 1908).

DHARAMPUR, a native state of India, in the Surat political agency division of Bombay, with an area of 704 sq. m. The population in 1901 was 100,430, being a decrease of 17 % during the decade; the estimated gross revenue is £25,412; and the tribute £600. Its chief is a Sesodia Rajput. The state has been surveyed for land revenue on the Bombay system. It contains one town, Dharampur (pop. in 1901, 63,449), and 272 villages. Only a small part of the state, the climate of which is very unhealthy, is capable of cultivation; the rest is covered with rocky hills, forest and brushwood.

[1] Nizam-ud-din, whose beautiful marble tomb is at Indarpat near Delhi, was, according to some authorities, an assassin of the secret society of Khorasan. By some modern authorities he is supposed to have been the founder of Thuggism, the Thugs having a special reverence for his memory.

DHARMSALA, a hill-station and sanatorium of the Punjab, India, situated on a spur of the Dhaola Dhar, 16 m. N.E. of Kangra town, at an elevation of some 6000 ft. Pop. (1901) 6971. The scenery of Dharmsala is of peculiar grandeur. The spur on which it stands is thickly wooded with oak and other trees; behind it the pine-clad slopes of the mountain tower towards the jagged peaks of the higher range, snow-clad for half the year; while below stretches the luxuriant cultivation of the Kangra valley. In 1855 Dharmsala was made the headquarters of the Kangra district of the Punjab in place of Kangra, and became the centre of a European settlement and cantonment, largely occupied by Gurkha regiments. The station was destroyed by the earthquake of April 1905, in which 1625 persons, including 25 Europeans and 112 of the Gurkha garrison, perished (*Imperial Gazetteer of India*, 1908).

DHARWAR, a town and district of British India, in the southern division of Bombay. The town has a station on the Southern Mahratta railway. The population in 1901 was 31,279. It has several ginning factories and a cotton-mill; two high schools, one maintained by the government and the other by the Basel German Mission.

The DISTRICT OF DHARWAR has an area of 4602 sq. m. In the north and north-east are great plains of black soil, favourable to cotton-growing; in the south and west are successive ranges of low hills, with flat fertile valleys between them. The whole district lies high and has no large rivers.

In 1901 the population was 1,113,298, showing an increase of 6 % in the decade. The most influential classes of the community are Brahmans and Lingayats. The Lingayats number 436,968, or 46 % of the Hindu population; they worship the symbol of Siva, and males and females both carry this emblem about their person in a silver case. The principal crops are millets, pulse and cotton. The centres of the cotton trade are Hubli and Gadag, junctions on the Southern Mahratta railway, which traverses the district in several directions.

The early history of the territory comprised within the district of Dharwar has been to a certain extent reconstructed from the inscription slabs and memorial stones which abound there. From these it is clear that the country fell in turn under the sway of the various dynasties that ruled in the Deccan, memorials of the Chalukyan dynasty, whether temples or inscriptions, being especially abundant. In the 14th century the district was first overrun by the Mahommedans, after which it was annexed to the newly established Hindu kingdom of Vijayanagar, an official of which named Dhar Rao, according to local tradition, built the fort at Dharwar town in 1403. After the defeat of the king of Vijayanagar at Talikot (1565), Dharwar was for a few years practically independent under its Hindu governor; but in 1573 the fort was captured by the sultan of Bijapur, and Dharwar was annexed to his dominions. In 1685 the fort was taken by the emperor Aurangzeb, and Dharwar, on the break-up of the Mogul empire, fell under the sway of the peshwa of Poona. In 1764 the province was overrun by Hyder Ali of Mysore, who in 1778 captured the fort of Dharwar. This was retaken in 1791 by the Mahrattas. On the final overthrow of the peshwa in 1817, Dharwar was incorporated with the territory of the East India Company.

DHOLPUR, a native state of India, in the Rajputana agency, with an area of 1155 sq. m. It is a crop-producing country, without any special manufactures. All along the bank of the river Chambal the country is deeply intersected by ravines; low ranges of hills in the western portion of the state supply inexhaustible quarries of fine-grained and easily-worked red sandstone. In 1901 the population of Dholpur was 270,973, showing a decrease of 3 % in the decade. The estimated revenue is £83,000. The state is crossed by the Indian Midland railway from Jhansi to Agra. In recent years it has suffered severely from drought. In 1896–1897 the expenditure on famine relief amounted to £8190.

The town of Dholpur is 34 m. S. of Agra by rail. Pop. (1901) 19,310. The present town, which dates from the 16th century, stands somewhat to the north of the site of the older Hindu town built, it is supposed, in the 11th century by the Tonwar Rajput Raja Dholan (or Dhawal) Deo, and named after him Dholdera or Dhawalpuri. Among the objects of interest in the town may be mentioned the fortified *sarai* built in the reign of Akbar, within which is the fine tomb of Sadik Mahommed Khan (d. 1595), one of his generals. The town, from its position on the railway, is growing in importance as a centre of trade.

Little is known of the early history of the country forming the state of Dholpur. Local tradition affirms that it was ruled by the Tonwar Rajputs, who had their seat at Delhi from the 8th to the 12th century. In 1450 it had a raja of its own; but in 1501 the fort of Dholpur was taken by the Mahommedans under Sikandar Lodi and in 1504 was transferred to a Mussulman governor. In 1527, after a strenuous resistance, the fort was captured by Baber and with the surrounding country passed under the sway of the Moguls, being included by Akbar in the province of Agra. During the dissensions which followed the death of Aurangzeb in 1707, Raja Kalyan Singh Bhadauria obtained possession of Dholpur, and his family retained it till 1761, after which it was taken successively by the Jat raja, Suraj Mal of Bharatpur, by Mirza Najaf Khan in 1775, by Sindhia in 1782, and in 1803 by the British. It was restored to Sindhia by the treaty of Sarji Anjangaon, but in consequence of new arrangements was again occupied by the British. Finally, in 1806, the territories of Dholpur, Bari and Rajakhera were handed over to the maharaj rana Kirat Singh, ancestor of the present chiefs of Dholpur, in exchange for his state of Gohad, which was ceded to Sindhia.

The maharaj rana of Dholpur belongs to the clan of Bamraolia Jats, who are believed to have formed a portion of the Indo-Scythian wave of invasion which swept over northern India about A.D. 100. An ancestor of the family appears to have held certain territories at Bamraoli near Agra *c.* 1195. His descendant in 1505, Singhan Deo, having distinguished himself in an expedition against the freebooters of the Deccan, was rewarded by the sovereignty of the small territory of Gohad, with the title of *rana*. In 1779 the rana of Gohad joined the British forces against Sindhia, under a treaty which stipulated that, at the conclusion of peace between the English and Mahrattas, all the territories then in his possession should be guaranteed to him, and protected from invasion by Sindhia. This protection was subsequently withdrawn, the rana having been guilty of treachery, and in 1783 Sindhia succeeded in recapturing the fortress of Gwalior, and crushed his Jat opponent by seizing the whole of Gohad. In 1804, however, the family were restored to Gohad by the British government; but, owing to the opposition of Sindhia, the rana agreed in 1805 to exchange Gohad for his present territory of Dholpur, which was taken under British protection, the chief binding himself to act in subordinate co-operation with the paramount power, and to refer all disputes with neighbouring princes to the British government. Kirat Singh, the first maharaj rana of Dholpur, was succeeded in 1836 by his son Bhagwant Singh, who showed great loyalty during the Mutiny of 1857, was created a K.C.S.I., and G.C.S.I. in 1869. He was succeeded in 1873 by his grandson Nihal Singh, who received the C.B. and frontier medal for services in the Tirah campaign. He died in 1901, and was succeeded by his eldest son Ram Singh (b. 1883).

See *Imperial Gazetteer of India* (Oxford, 1908) and authorities there given.

DHOW, the name given to a type of vessel used throughout the Arabian Sea. The language to which the word belongs is unknown. According to the *New English Dictionary* the place of origin may be the Persian Gulf, assuming that the word is identical with the *tava* mentioned by Athanasius Nikitin (*India in the 15th Century*, Hakluyt Society, 1858). Though the word is used generally of any craft along the East African coast, it is usually applied to the vessel of about 150 to 200 tons burden with a stem rising with a long slope from the water; dhows generally have one mast with a lateen sail, the yard being of enormous length. Much of the coasting trade of the Red Sea and Persian Gulf is carried on by these vessels. They were the regular vessels employed in the slave trade from the east coast of Africa.

DHRANGADRA, a native state of India, in the Gujarat division of Bombay, situated in the north of the peninsula of Kathiawar. Its area is 1156 sq. m. Pop. (1901) 70,880. The estimated gross revenue is £38,000 and the tribute £3000. A state railway on the metre gauge from Wadhwan to the town of Dhrangadra, a distance of 21 m., was opened for traffic in 1898. Some cotton is grown, although the soil is as a whole poor; the manufactures include salt, metal vessels and stone hand-mills. The chief town, Dhrangadra, has a population (1901) of 14,770.

The chief of Dhrangadra, who bears the title of Raj Sahib, with the predicate of His Highness, is head of the ancient clan of Jhala Rajputs, who are said to have entered Kathiawar from Sind in the 8th century. Raj Sahib Sir Mansinghji Ranmalsinghji (b. 1837), who succeeded his father in 1869, was distinguished for the enlightened character of his administration, especially in the matter of establishing schools and internal communications. He was created a K.C.S.I. in 1877. He died in 1900, and was succeeded by his grandson Ajitsinghji Jaswatsinghji (b. 1872).

DHULEEP SINGH (1837–1893), maharaja of Lahore, was born in February 1837, and was proclaimed maharaja on the 18th of September 1843, under the regency of his mother the rani Jindan, a woman of great capacity and strong will, but extremely inimical to the British. He was acknowledged by Ranjit Singh and recognized by the British government. After six years of peace the Sikhs invaded British territory in 1845, but were defeated in four battles, and terms were imposed upon them at Lahore, the capital of the Punjab. Dhuleep Singh retained his territory, but it was administered to a great extent by the British government in his name. This arrangement increased the regent's dislike of the British, and a fresh outbreak occurred in 1848–49. In spite of the valour of the Sikhs, they were utterly routed at Gujarat, and in March 1849 Dhuleep Singh was deposed, a pension of £40,000 a year being granted to him and his dependants. He became a Christian and elected to live in England. On coming of age he made an arrangement with the British government by which his income was reduced to £25,000 in consideration of advances for the purchase of an estate, and he finally settled at Elvedon in Suffolk. While passing through Alexandria in 1864 he met Miss Bamba Müller, the daughter of a German merchant who had married an Abyssinian. The maharaja had been interested in mission work by Sir John Login, and he met Miss Müller at one of the missionary schools where she was teaching. She became his wife on the 7th of June 1864, and six children were the issue of the marriage. In the year after her death in 1890 the maharaja married at Paris, as his second wife, an English lady, Miss Ada Douglas Wetherill, who survived him. The maharaja was passionately fond of sport, and his shooting parties were celebrated, while he himself became a *persona grata* in English society. The result, however, was financial difficulty, and in 1882 he appealed to the government for assistance, making various claims based upon the alleged possession of private estates in the Punjab, and upon the surrender of the Koh-i-nor diamond to the British Crown. His demand was rejected, whereupon he started for India, after drawing up a proclamation to his former subjects. But as it was deemed inadvisable to allow him to visit the Punjab, he remained for some time as a guest at the residency at Aden, and was allowed to receive some of his relatives to witness his abjuration of Christianity, which actually took place within the residency itself. As the climate began to affect his health, the maharaja at length left Aden and returned to Europe. He stayed for some time in Russia, hoping that his claim against England would be taken up by the Russians; but when that expectation proved futile he proceeded to Paris, where he lived for the rest of his life on the pension allowed him by the Indian government. His death from an attack of apoplexy took place at Paris on the 22nd of October 1893. The maharaja's eldest son, Prince Victor Albert Jay Dhuleep Singh (b. 1866), was educated at Trinity and Downing Colleges, Cambridge. In 1888 he obtained a commission in the 1st Royal Dragoon Guards. In 1898 he married Lady Anne Coventry, youngest daughter of the earl of Coventry. (G. F. B.)

DHULIA, a town of British India, administrative headquarters of West Khandesh district in Bombay, on the right bank of the Panjhra river. Pop. (1901) 24,726. Considerable trade is done in cotton and oil-seeds, and weaving of cotton. A railway connects Dhulia with Chalisgaon, on the main line of the Great Indian Peninsula railway.

DIABASE, in petrology, a rock which is a weathered form of dolerite. It was long widely accepted that the pre-Tertiary rocks of this group differed from their Tertiary and Recent representatives in certain essential respects, but this is now admitted to be untenable, and the differences are known to be merely the result of the longer exposure to decomposition, pressure and shearing, which the older rocks have experienced. Their olivine tends to become serpentinized; their augite changes to chlorite and uralite; their felspars are clouded by formation of zeolites, calcite, sericite and epidote. The rocks acquire a green colour (from the development of chlorite, uralite and epidote); hence the older name of "greenstones," which is now little used. Many of them become somewhat schistose from pressure ("greenstone-schists," meta-diabase, &c.). Although the original definition of the group can no longer be justified, the name is so well established in current usage that it can hardly be discarded. The terms diabase and dolerite are employed really to designate distinct facies of the same set of rocks.

The minerals of diabase are the same as those of dolerite, viz. olivine, augite, and plagioclase felspar, with subordinate quantities of hornblende, biotite, iron oxides and apatite.

There are olivine-diabases and diabases without olivine; quartz-diabases, analcite-diabases (or teschenites) and hornblende diabases (or proterobases). Hypersthene (or bronzite) is characteristic of another group. Many of them are ophitic, especially those which contain olivine, but others are intersertal, like the intersertal dolerites. The last include most quartz-diabases, hypersthene-diabases and the rocks which have been described as tholeites. Porphyritic structure appears in the diabase-porphyrites, some of which are highly vesicular and contain remains of an abundant fine-grained or partly glassy ground-mass (*diabas-mandelstein*, amygdaloidal diabase). The somewhat ill-defined spilites are regarded by many as modifications of diabase-porphyrite. In the intersertal and porphyrite diabases, fresh or devitrified glassy base is not infrequent. It is especially conspicuous in some tholeites (hyalo-tholeites) and in weisselbergites. These rocks consist of augite and plagioclase, with little or no olivine, on a brown, vitreous, interstitial matrix. Devitrified forms of tachylyte (sordawilite, &c.) occur at the rapidly chilled margins of dolerite sills and dikes, and fine-grained spotted rocks with large spherulites of grey or greenish felspar, and branching growths of brownish-green augite (variolites).

To nearly every variety in composition and structure presented by the diabases, a counterpart can be found among the Tertiary dolerites. In the older rocks, however, certain minerals are more common than in the newer. Hornblende, mostly of pale green colours and somewhat fibrous habit, is very frequent in diabase; it is in most cases secondary after pyroxene, and is then known as uralite; often it forms pseudomorphs which retain the shape of the original augite. Where diabases have been crushed or sheared, hornblende readily develops at the expense of pyroxene, sometimes replacing it completely. In the later stages of alteration the amphibole becomes compact and well crystallized; the rocks consist of green hornblende and plagioclase felspar, and are then generally known as epidiorites or amphibolites. At the same time a schistose structure is produced. But transition forms are very common, having more or less of the augite remaining, surrounded by newly formed hornblende which at first is rather fibrous and tends to spread outwards through the surrounding felspar. Chlorite also is abundant both in sheared and unsheared diabases, and with it calcite may make its appearance, or the lime set free from the augite may combine with the titanium of the iron oxide and with silica to form incrustations or borders of sphene around the original crystals of ilmenite. Epidote is another secondary lime-bearing mineral which results from the decomposition of the soda lime felspars and the pyroxenes. Many diabases, especially those of the teschenite sub-group, are filled with zeolites.

Diabases are exceedingly abundant among the older rocks of all parts of the globe. Popular names for them are "whinstone," "greenstone," "toadstone" and "trap." They form excellent road-mending stones and are much quarried for this purpose, being tough, durable and resistant to wear, so long as they are not extremely decomposed. Many of them are to be preferred to the fresher dolerites as being less brittle. The quality of the Cornish greenstones appears to have been distinctly improved by a smaller amount of recrystallization where they have been heated by contact with intrusive masses of granite. (J. S. F.)

DIABETES (from Gr. διά, through, and βαίνειν, to pass), a constitutional disease characterized by a habitually excessive discharge of urine. Two forms of this complaint are described, viz. Diabetes Mellitus, or Glycosuria, where the urine is not only increased in quantity, but persistently contains a greater or less amount of sugar, and Diabetes Insipidus, or Polyuria, where the urine is simply increased in quantity, and contains no abnormal ingredient. This latter, however, must be distinguished from the polyuria due to chronic granular kidney, lardaceous disease of the kidney, and also occurring in certain cases of hysteria.

Diabetes mellitus is the disease to which the term is most commonly applied, and is by far the more serious and important ailment. It is one of the diseases due to altered metabolism (see METABOLIC DISEASES). It is markedly hereditary, much more prevalent in towns and especially modern city life than in more primitive rustic communities, and most common among the Jews. The excessive use of sugar as a food is usually considered one cause of the disease, and obesity is supposed to favour its occurrence, but many observers consider that the obesity so often met with among diabetics is due to the same cause as the disease itself. No age is exempt, but it occurs most commonly in the fifth decade of life. It attacks males twice as frequently as females, and fair more frequently than dark people.

The symptoms are usually gradual in their onset, and the patient may suffer for a length of time before he thinks it necessary to apply for medical aid. The first symptoms which attract attention are failure of strength, and emaciation, along with great thirst and an increased amount and frequent passage of urine. From the normal quantity of from 2 to 3 pints in the 24 hours it may be increased to 10, 20 or 30 pints, or even more. It is usually of pale colour, and of thicker consistence than normal urine, possesses a decidedly sweet taste, and is of high specific gravity (1030 to 1050). It frequently gives rise to considerable irritation of the urinary passages.

By simple evaporation crystals of sugar may be obtained from diabetic urine, which also yields the characteristic chemical tests of sugar, while the amount of this substance can be accurately estimated by certain analytical processes. The quantity of sugar passed may vary from a few ounces to two or more pounds per diem, and it is found to be markedly increased after saccharine or starchy food has been taken. Sugar may also be found in the blood, saliva, tears, and in almost all the excretions of persons suffering from this disease. One of the most distressing symptoms is intense thirst, which the patient is constantly seeking to allay; the quantity of liquid consumed being in general enormous, and there is usually, but not invariably, a voracious appetite. The mouth is always parched, and a faint, sweetish odour may be evolved from the breath. The effect of the disease upon the general health is very marked, and the patient becomes more and more emaciated. He suffers from increasing muscular weakness, the temperature of his body is lowered, and the skin is dry and harsh. There is often a peculiar flush on the face, not limited to the malar eminences, but extending up to the roots of the hair. The teeth are loosened or decay, there is a tendency to bleeding from the gums, while dyspeptic symptoms, constipation and loss of sexual power are common accompaniments. There is in general great mental depression or irritability.

Diabetes as a rule advances comparatively slowly except in the case of young persons, in whom its progress is apt to be rapid. The complications of the disease are many and serious. It may cause impaired vision by weakening the muscles of accommodation, or by lessening the sensitiveness of the retina to light. Also cataract is very common. Skin affections of all kinds may occur and prove very intractable. Boils, carbuncles, cellulitis and gangrene are all apt to occur as life advances, though gangrene is much more frequent in men than in women. Diabetics are especially liable to phthisis and pneumonia, and gangrene of the lungs may set in if the patient survives the crisis in the latter disease. Digestive troubles of all kinds, kidney diseases and heart failure due to fatty heart are all of common occurrence. Also patients seem curiously susceptible to the poison of enteric fever, though the attack usually runs a mild course. The sugar temporarily disappears during the fever. But the most serious complication of all is known as diabetic coma, which is very commonly the final cause of death. The onset is often insidious, but may be indicated by loss of appetite, a rapid fall in the quantity of both urine and sugar, and by either constipation or diarrhoea. More rarely there is most acute abdominal pain. At first the condition is rather that of collapse than true coma, though later the patient is absolutely comatose. The patient suffers from a peculiar kind of dyspnoea, and the breath and skin have a sweet ethereal odour. The condition may last from twenty-four hours to three days, but is almost invariably the precursor of death.

Diabetes is a very fatal form of disease, recovery being exceedingly rare. Over 50 % die of coma, another 25 % of phthisis or pneumonia, and the remainder of Bright's disease, cerebral haemorrhage, gangrene, &c. The most favourable cases are those in which the patient is advanced in years, those in which it is associated with obesity or gout, and where the social conditions are favourable. A few cures have been recorded in which the disease supervened after some acute illness. The unfavourable cases are those in which there is a family history of the disease and in which the patient is young. Nevertheless much may be done by appropriate treatment to mitigate the severity of the symptoms and to prolong life.

There are two distinct lines of treatment, that of diet and that of drugs, but each must be modified and determined entirely by the idiosyncrasy of the patient, which varies in this condition between very wide limits. That of diet is of primary importance inasmuch as it has been proved beyond question that certain kinds of food have a powerful influence in aggravating the disease, more particularly those consisting largely of saccharine and starchy matter; and it may be stated generally that the various methods of treatment proposed aim at the elimination as far as possible of these constituents from the diet. Hence it is recommended that such articles as bread, potatoes and all farinaceous foods, turnips, carrots, parsnips and most fruits should be avoided; while animal food and soups, green vegetables, cream, cheese, eggs, butter, and tea and coffee without sugar, may be taken with advantage. As a substitute for ordinary bread, which most persons find it difficult to do without for any length of time, bran bread, gluten bread and almond biscuits. A patient must never pass suddenly from an ordinary to a carbohydrate-free diet. Any such sudden transition is extremely liable to bring on diabetic coma, and the change must be made quite gradually, one form of carbohydrate after another being taken out of the diet, whilst the effect on the quantity of sugar passed is being carefully noted meanwhile. The treatment may be begun by excluding potatoes, sugar and fruit, and only after several days is the bread to be replaced by some diabetic substitute. When the sugar excretion has been reduced to its lowest point, and maintained there for some time, a certain amount of carbohydrate may be cautiously allowed, the consequent effect on the glycosuria being estimated. The best diet can only be worked out experimentally for each individual patient. But in every case, if drowsiness or any symptom suggesting coma supervene, all restrictions must be withdrawn, and carbohydrate freely allowed. The question of alcohol is one which must be largely determined by the previous history of the patient, but a small quantity will help to make up the deficiencies of a diet poor in carbohydrate. Scotch and Irish whisky, and Hollands gin, are usually free from sugar, and some of the light Bordeaux wines contain very little. Fat is beneficial, and can be given as cream, fat of meat and cod-liver oil. Green vegetables are harmless, but the white stalks of cabbages and lettuces and also celery and endive yield sugar. Laevulose can be assimilated up to 1½ ozs. daily without increasing the glycosuria, and hence apples, cooked or raw, are allowable, as the sugar they contain is in this form. The question of milk is somewhat disputed; but it is usual to exclude it from the rigid diet, allowing a certain quantity when the diet is being extended. Thirst is relieved by anything that relieves the polyuria. But hypodermic injections of pilocarpine stimulate the flow of saliva, and thus relieve the dryness of the

mouth. Constipation appears to increase the thirst, and must always be carefully guarded against. The best remedies are the aperient mineral waters.

Numerous medicinal substances have been employed in diabetes, but few of them are worthy of mention as possessed of any efficacy. Opium is often found of great service, its administration being followed by marked amelioration in all the symptoms. Morphia and codeia have a similar action. In the severest cases, however, these drugs appear to be of little or no use, and they certainly increase the constipation. Heroin hydrochloride has been tried in their place, but this seems to have more power over slight than over severe cases. Salicylate of sodium and aspirin are both very beneficial, causing a diminution in the sugar excretion without counterbalancing bad effects.

In *diabetes insipidus* there is constant thirst and an excessive flow of urine, which, however, is not found to contain any abnormal constituent. Its effects upon the system are often similar to those of diabetes mellitus, except that they are much less marked, the disease being in general very slow in its progress. In some cases the health appears to suffer very slightly. It is rarely a direct cause of death, but from its debilitating effects may predispose to serious and fatal complications. It is best treated by tonics and generous diet. Valerian has been found beneficial, the powdered root being given in 5-grain doses.

DIABOLO, a game played with a sort of top in the shape of two cones joined at their apices, which is spun, thrown, and caught by means of a cord strung to two sticks. The idea of the game appears originally to have come from China, where a top (*Kouengen*), made of two hollow pierced cylinders of metal or wood, joined by a rod—and often of immense size,—was made by rotation to hum with a loud noise, and was used by pedlars to attract customers. From China it was introduced by missionaries to Europe; and a form of the game, known as "the devil on two sticks," appears to have been known in England towards the end of the 18th century, and Lord Macartney is credited with improvements in it. But its principal vogue was in France in 1812, where the top was called "le diable." Amusing old prints exist (see *Fry's Magazine*, March and December 1907), depicting examples of the popular craze in France at the time. The *diable* of those days resembled a globular wooden dumb-bell with a short waist, and the sonorous hum when spinning—the *bruit du diable*—was a pronounced feature. At intervals during the century occasional attempts to revive the game of spinning a top of this sort on a string were made, but it was not till 1906 that the sensation of 1812 began to be repeated. A French engineer, Gustave Phillipart, discovering some old implements of the game, had experimented for some time with new forms of top with a view to bringing it again into popularity; and having devised the double-cone shape, and added a miniature bicycle tire of rubber round the rims of the two ends of the double-cone, with other improvements, he named it "diabolo." The use of celluloid in preference to metal or wood as its material appears to have been due to a suggestion of Mr C. B. Fry, who was consulted by the inventor on the subject. The game of spinning, throwing and catching the diabolo was rapidly elaborated in various directions, both as an exercise of skill in doing tricks, and in "diabolo tennis" and other ways as an athletic pastime. From Paris, Ostend and the chief French seaside resorts, where it became popular in 1906, its vogue spread in 1907 so that in France and England it became the fashionable "rage" among both children and adults.

The mechanics of the diabolo were worked out by Professor C. V. Boys in the *Proc. Phys. Soc.* (London), Nov. 1907.

DIACONICON, in the Greek Church, the name given to a chamber on the south side of the central apse, where the sacred utensils, vessels, &c., of the church were kept. In the reign of Justin II. (565–574), owing to a change in the liturgy, the diaconicon and prothesis were located in apses at the east end of the aisles. Before that time there was only one apse. In the churches in central Syria of slightly earlier date, the diaconicon is rectangular, the side apses at Kalat-Seman having been added at a later date.

DIADOCHI (Gr. διαδέχεσθαι, to receive from another), *i.e.* "Successors," the name given to the Macedonian generals who fought for the empire of Alexander after his death in 323 B.C. The name includes Antigonus and his son Demetrius Poliorcetes, Antipater and his son Cassander, Seleucus, Ptolemy, Eumenes and Lysimachus. The kingdoms into which the Macedonian empire was divided under these rulers are known as Hellenistic. The chief were Asia Minor and Syria under the Seleucid Dynasty (*q.v.*), Egypt under the Ptolemies (*q.v.*), Macedonia under the successors of Antigonus Gonatas, Pergamum (*q.v.*) under the Attalid dynasty. Gradually these kingdoms were merged in the Roman empire. (See MACEDONIAN EMPIRE.)

DIAGONAL (Gr. διά, through, γωνία, a corner), in geometry, a line joining the intersections of two pairs of sides of a rectilinear figure.

DIAGORAS, of Melos, surnamed the Atheist, poet and sophist, flourished in the second half of the 5th century B.C. Religious in his youth and a writer of hymns and dithyrambs, he became an atheist because a great wrong done to him was left unpunished by the gods. In consequence of his blasphemous speeches, and especially his criticism of the Mysteries, he was condemned to death at Athens, and a price set upon his head (Aristoph. *Clouds*, 830; *Birds*, 1073 and Schol.). He fled to Corinth, where he is said to have died. His work on the Mysteries was called Φρύγιοι λόγοι or Ἀποπυργίζοντες, in which he probably attacked the Phrygian divinities.

DIAGRAM (Gr. διάγραμμα, from διαγράφειν, to mark out by lines, a figure drawn in such a manner that the geometrical relations between the parts of the figure illustrate relations between other objects. They may be classed according to the manner in which they are intended to be used, and also according to the kind of analogy which we recognize between the diagram and the thing represented. The diagrams in mathematical treatises are intended to help the reader to follow the mathematical reasoning. The construction of the figure is defined in words so that even if no figure were drawn the reader could draw one for himself. The diagram is a good one if those features which form the subject of the proposition are clearly represented.

Diagrams are also employed in an entirely different way—namely, for purposes of measurement. The plans and designs drawn by architects and engineers are used to determine the value of certain real magnitudes by measuring certain distances on the diagram. For such purposes it is essential that the drawing be as accurate as possible. We therefore class diagrams as diagrams of illustration, which merely suggest certain relations to the mind of the spectator, and diagrams drawn to scale, from which measurements are intended to be made. There are some diagrams or schemes, however, in which the form of the parts is of no importance, provided their connexions are properly shown. Of this kind are the diagrams of electrical connexions, and those belonging to that department of geometry which treats of the degrees of cyclosis, periphraxy, linkedness and knottedness.

Diagrams purely Graphic and mixed Symbolic and Graphic.—Diagrams may also be classed either as purely graphical diagrams, in which no symbols are employed except letters or other marks to distinguish particular points of the diagrams, and mixed diagrams, in which certain magnitudes are represented, not by the magnitudes of parts of the diagram, but by symbols, such as numbers written on the diagram. Thus in a map the height of places above the level of the sea is often indicated by marking the number of feet above the sea at the corresponding places on the map. There is another method in which a line called a contour line is drawn through all the places in the map whose height above the sea is a certain number of feet, and the number of feet is written at some point or points of this line. By the use of a series of contour lines, the height of a great number of places can be indicated on a map by means of a small number of written symbols. Still this method is not a purely graphical method, but a partly symbolical method of expressing the third dimension of objects on a diagram in two dimensions.

In order to express completely by a purely graphical method the relations of magnitudes involving more than two variables, we must use more than one diagram. Thus in the arts of construction we use plans and elevations and sections through different planes, to specify the form of objects having three

dimensions. In such systems of diagrams we have to indicate that a point in one diagram corresponds to a point in another diagram. This is generally done by marking the corresponding points in the different diagrams with the same letter. If the diagrams are drawn on the same piece of paper we may indicate corresponding points by drawing a line from one to the other, taking care that this line of correspondence is so drawn that it cannot be mistaken for a real line in either diagram. (See GEOMETRY: *Descriptive.*)

In the stereoscope the two diagrams, by the combined use of which the form of bodies in three dimensions is recognized, are projections of the bodies taken from two points so near each other that, by viewing the two diagrams simultaneously, one with each eye, we identify the corresponding points intuitively. The method in which we simultaneously contemplate two figures, and recognize a correspondence between certain points in the one figure and certain points in the other, is one of the most powerful and fertile methods hitherto known in science. Thus in pure geometry the theories of similar, reciprocal and inverse figures have led to many extensions of the science. It is sometimes spoken of as the method or principle of Duality. (See GEOMETRY: *Projective.*)

DIAGRAMS IN MECHANICS

The study of the motion of a material system is much assisted by the use of a series of diagrams representing the configuration, displacement and acceleration of the parts of the system.

Diagram of Configuration.—In considering a material system it is often convenient to suppose that we have a record of its position at any given instant in the form of a diagram of configuration. The position of any particle of the system is defined by drawing a straight line or vector from the origin, or point of reference, to the given particle. The position of the particle with respect to the origin is determined by the magnitude and direction of this vector. If in the diagram we draw from the origin (which need not be the same point of space as the origin for the material system) a vector equal and parallel to the vector which determines the position of the particle, the end of this vector will indicate the position of the particle in the diagram of configuration. If this is done for all the particles we shall have a system of points in the diagram of configuration, each of which corresponds to a particle of the material system, and the relative positions of any pair of these points will be the same as the relative positions of the material particles which correspond to them.

We have hitherto spoken of two origins or points from which the vectors are supposed to be drawn—one for the material system, the other for the diagram. These points, however, and the vectors drawn from them, may now be omitted, so that we have on the one hand the material system and on the other a set of points, each point corresponding to a particle of the system, and the whole representing the configuration of the system at a given instant.

This is called a diagram of configuration.

Diagram of Displacement.—Let us next consider two diagrams of configuration of the same system, corresponding to two different instants. We call the first the initial configuration and the second the final configuration, and the passage from the one configuration to the other we call the displacement of the system. We do not at present consider the length of time during which the displacement was effected, nor the intermediate stages through which it passed, but only the final result—a change of configuration. To study this change we construct a diagram of displacement.

Let A, B, C be the points in the initial diagram of configuration, and A′, B′, C′ be the corresponding points in the final diagram of configuration. From *o*, the origin of the diagram of displacement, draw a vector *oa* equal and parallel to AA′, *ob* equal and parallel to BB′, *oc* to CC′, and so on. The points *a*, *b*, *c*, &c., will be such that the vector *ab* indicates the displacement of B relative to A, and so on. The diagram containing the points *a*, *b*, *c*, &c., is therefore called the diagram of displacement.

In constructing the diagram of displacement we have hitherto assumed that we know the absolute displacements of the points of the system. For we are required to draw a line equal and parallel to AA′, which we cannot do unless we know the absolute final position of A, with respect to its initial position. In this diagram of displacement there is therefore, besides the points *a*, *b*, *c*, &c., an *origin*, *o*, which represents a point absolutely fixed in space. This is necessary because the two configurations do not exist at the same time; and therefore to express their relative position we require to know a point which remains the same at the beginning and end of the time.

But we may construct the diagram in another way which does not assume a knowledge of absolute displacement or of a point fixed in space. Assuming any point and calling it *a*, draw *ab* parallel and equal to BA in the initial configuration, and from *b* draw *bb* parallel and equal to A′B′ in the final configuration. It is easy to see that the position of the point *b* relative to *a* will be the same by this construction as by the former construction, only we must observe that in this second construction we use only vectors such as AB, A′B′, which represent the relative position of points both of which exist simultaneously, instead of vectors such as AA′, BB′, which express the position of a point at one instant relative to its position at a former instant, and which therefore cannot be determined by observation, because the two ends of the vector do not exist simultaneously.

It appears therefore that the diagram of displacements, when drawn by the first construction, includes an origin *o*, which indicates that we have assumed a knowledge of absolute displacements. But no such point occurs in the second construction, because we use such vectors only as we can actually observe. Hence the diagram of displacements *without an origin* represents neither more nor less than all we can ever know about the displacement of the material system.

Diagram of Velocity.—If the relative velocities of the points of the system are constant, then the diagram of displacement corresponding to an interval of a unit of time between the initial and the final configuration is called a diagram of relative velocity. If the relative velocities are not constant, we suppose another system in which the velocities are equal to the velocities of the given system at the given instant and continue constant for a unit of time. The diagram of displacements for this imaginary system is the required diagram of relative velocities of the actual system at the given instant. It is easy to see that the diagram gives the velocity of any one point relative to any other, but cannot give the absolute velocity of any of them.

Diagram of Acceleration.—By the same process by which we formed the diagram of displacements from the two diagrams of initial and final configuration, we may form a diagram of changes of relative velocity from the two diagrams of initial and final velocities. This diagram may be called that of total accelerations in a finite interval of time. And by the same process by which we deduced the diagram of velocities from that of displacements we may deduce the diagram of rates of acceleration from that of total acceleration.

We have mentioned this system of diagrams in elementary kinematics because they are found to be of use especially when we have to deal with material systems containing a great number of parts, as in the kinetic theory of gases. The diagram of configuration then appears as a region of space swarming with points representing molecules, and the only way in which we can investigate it is by considering the number of such points in unit of volume in different parts of that region, and calling this the *density* of the gas.

In like manner the diagram of velocities appears as a region containing points equal in number but distributed in a different manner, and the number of points in any given portion of the region expresses the number of molecules whose velocities lie within given limits. We may speak of this as the velocity-density.

Diagrams of Stress.—Graphical methods are peculiarly applicable to statical questions, because the state of the system is constant, so that we do not need to construct a series of diagrams corresponding to the successive states of the system. The most useful of these applications, collectively termed Graphic Statics, relates to the equilibrium of plane framed structures familiarly represented in bridges and roof-trusses. Two diagrams are used, one called the diagram of the frame and the other called the diagram of stress. The structure itself consists of a number of separable pieces or links jointed together at their extremities. In practice these joints have friction, or may be made purposely stiff, so that the force acting at the extremity of a piece may not pass exactly through the axis of the joint; but as it is unsafe to make the stability of the structure depend in any degree upon the stiffness of joints, we assume in our calculations that all the joints are perfectly smooth, and therefore that the force acting on the end of any link passes through the axis of the joint.

The axes of the joints of the structure are represented by points in the diagram of the frame. The link which connects two joints in the actual structure may be of any shape, but in the diagram of the frame it is represented by a straight line joining the points representing the two joints. If no force acts on the link except the two forces acting through the centres of the joints, these two forces must be equal and opposite, and their direction must coincide with the straight line joining the centres of the joints. If the force acting on either extremity of the link is directed towards the other extremity, the stress on the link is called pressure and the link is called a "strut." If it is directed away from the other extremity, the stress on the link is called tension and the link is called a "tie." In this case, therefore, the only stress acting in a link is a pressure or a tension in the direction of the straight line which represents it in the diagram of the frame, and all that we have to do is to find the magnitude of this stress. In the actual structure gravity acts on every part of the link, but in the diagram we substitute for the actual weight of the different parts of the link two weights which have the same resultant acting at the extremities of the link.

We may now treat the diagram of the frame as composed of links without weight, but loaded at each joint with a weight made up of portions of the weights of all the links which meet in that joint. If any link has more than two joints we may substitute for it in the diagram an imaginary stiff frame, consisting of links, each of which has only two joints. The diagram of the frame is now reduced to a system of points, certain pairs of which are joined by straight lines, and each point is in general acted on by a weight or other force acting between it and some point external to the system. To complete

the diagram we may represent these external forces as links, that is to say, straight lines joining the points of the frame to points external to the frame. Thus each weight may be represented by a link joining the point of application of the weight with the centre of the earth.

But we can always construct an imaginary frame having its joints in the lines of action of these external forces, and this frame, together with the real frame and the links representing external forces, which join points in the one frame to points in the other frame, make up together a complete self-strained system in equilibrium, consisting of points connected by links acting by pressure or tension. We may in this way reduce any real structure to the case of a system of points with attractive or repulsive forces acting between certain pairs of these points, and keeping them in equilibrium. The direction of each of these forces is sufficiently indicated by that of the line joining the points, so that we have only to determine its magnitude. We might do this by calculation, and then write down on each link the pressure or the tension which acts in it.

We should in this way obtain a mixed diagram in which the stresses are represented graphically as regards direction and position, but symbolically as regards magnitude. But we know that a force may be represented in a purely graphical manner by a straight line in the direction of the force containing as many units of length as there are units of force in the force. The end of this line is marked with an arrow head to show in which direction the force acts. According to this method each force is drawn in its proper position in the diagram of configuration of the frame. Such a diagram might be useful as a record of the result of calculation of the magnitude of the forces, but it would be of no use in enabling us to test the correctness of the calculation.

But we have a graphical method of testing the equilibrium of any set of forces acting at a point. We draw in series a set of lines parallel and proportional to these forces. If these lines form a closed polygon the forces are in equilibrium. (See MECHANICS.) We might in this way form a series of polygons of forces, one for each joint of the frame. But in so doing we give up the principle of drawing the line representing a force from the point of application of the force, for all the sides of the polygon cannot pass through the same point, as the forces do. We also represent every stress twice over, for it appears as a side of both the polygons corresponding to the two joints between which it acts. But if we can arrange the polygons in such a way that the sides of any two polygons which represent the same stress coincide with each other, we may form a diagram in which every stress is represented in direction and magnitude, though not in position, by a single line which is the common boundary of the two polygons which represent the joints at the extremities of the corresponding piece of the frame.

We have thus obtained a pure diagram of stress in which no attempt is made to represent the configuration of the material system, and in which every force is not only represented in direction and magnitude by a straight line, but the equilibrium of the forces at any joint is manifest by inspection, for we have only to examine whether the corresponding polygon is closed or not.

The relations between the diagram of the frame and the diagram of stress are as follows:—To every link in the frame corresponds a straight line in the diagram of stress which represents in magnitude and direction the stress acting in that link; and to every joint of the frame corresponds a closed polygon in the diagram, and the forces acting at that joint are represented by the sides of the polygon taken in a certain cyclical order, the cyclical order of the sides of the two adjacent polygons being such that their common side is traced in opposite directions in going round the two polygons.

The direction in which any side of a polygon is traced is the direction of the force acting on that joint of the frame which corresponds to the polygon, and due to that link of the frame which corresponds to the side. This determines whether the stress of the link is a pressure or a tension. If we know whether the stress of any one link is a pressure or a tension, this determines the cyclical order of the sides of the two polygons corresponding to the ends of the links, and therefore the cyclical order of all the polygons, and the nature of the stress in every link of the frame.

Reciprocal Diagrams.—When to every point of concourse of the lines in the diagram of stress corresponds a closed polygon in the skeleton of the frame, the two diagrams are said to be reciprocal.

The first extensions of the method of diagrams of forces to other cases than that of the funicular polygon were given by Rankine in his *Applied Mechanics* (1857). The method was independently applied to a large number of cases by W. P. Taylor, a practical draughtsman in the office of J. B. Cochrane, and by Professor Clerk Maxwell in his lectures in King's College, London. In the *Phil. Mag.* for 1864 the latter pointed out the reciprocal properties of the two diagrams, and in a paper on "Reciprocal Figures, Frames and Diagrams of Forces," *Trans. R.S. Edin.* vol. xxvi., 1870, he showed the relation of the method to Airy's function of stress and to other mathematical methods. Professor Fleeming Jenkin has given a number of applications of the method to practice (*Trans. R.S. Edin.* vol. xxv.).

L. Cremona (*Le Figure reciproche nella statica grafica*, 1872) deduced the construction of reciprocal figures from the theory of the two components of a wrench as developed by Möbius. Karl Culmann, in his *Graphische Statik* (1st ed. 1864–1866, 2nd ed. 1875), made great use of diagrams of forces, some of which, however, are not reciprocal. Maurice Levy in his *Statique graphique* (1874) has treated the whole subject in an elementary but copious manner, and R. H. Bow, in his *The Economics of Construction in Relation to Framed Structures* (1873), materially simplified the process of drawing a diagram of stress reciprocal to a given frame acted on by a system of equilibrating external forces.

Instead of lettering the joints of the frame, as is usually done, or the links of the frame, as was the custom of Clerk Maxwell, Bow places a letter in each of the polygonal areas enclosed by the links of the frame, and also in each of the divisions of surrounding space as

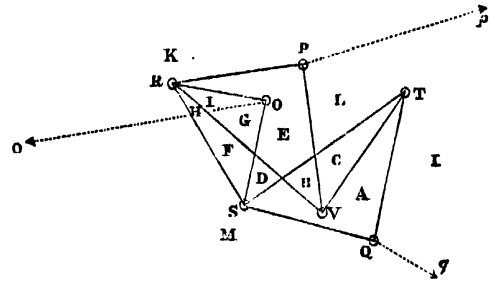

FIG. 1.—Diagram of Configuration.

separated by the lines of action of the external forces. When one link of the frame crosses another, the point of apparent intersection of the links is treated as if it were a real joint, and the stresses of each of the intersecting links are represented twice in the diagram of stress, as the opposite sides of the parallelogram which corresponds to the point of intersection.

This method is followed in the lettering of the diagram of configuration (fig. 1), and the diagram of stress (fig. 2) of the linkwork which Professor Sylvester has called a quadruplane.

In fig. 1 the real joints are distinguished from the places where one link appears to cross another by the little circles O, P, Q, R, S, T, V. The four links RSTV form a "contraparallelogram" in which RS=TV and RV=ST. The triangles ROS, RPV, TQS are similar to each other. A fourth triangle (TNV), not drawn in the figure, would complete the quadruplane. The four points O, P, N, Q form a parallelogram whose angle POQ is constant and equal to π − SOR. The product of the distances OP and OQ is constant. The linkwork may be fixed at O. If any figure is traced by P, Q will trace the

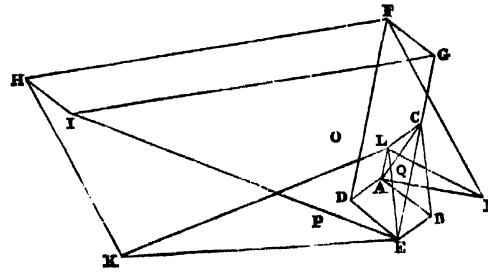

FIG. 2.—Diagram of Stress.

inverse figure, but turned round O through the constant angle POQ. In the diagram forces P*p*, Q*q* are balanced by the force O*o* at the fixed point. The forces P*p* and Q*q* are necessarily inversely as OP and OQ, and make equal angles with those lines.

Every closed area formed by the links or the external forces in the diagram of configuration is marked by a letter which corresponds to a point of concourse of lines in the diagram of stress. The stress in the link which is the common boundary of two areas is represented in the diagram of stress by the line joining the points corresponding to those areas. When a link is divided into two or more parts by lines crossing it, the stress in each part is represented by a different line for each part, but as the stress is the same throughout the link these lines are all equal and parallel. Thus in the figure the stress in RV is represented by the four equal and parallel lines HI, FG, DE and AB. If two areas have no part of their boundary in common the letters corresponding to them in the diagram of stress are not joined by a straight line. If, however, a straight line were drawn between them, it would represent in direction and magnitude the resultant of all the stresses in the links which are cut by any line, straight or curved, joining the two areas. For instance the areas F and C in fig. 1 have no common boundary, and the points F and C in fig. 2 are not joined by a straight line. But every path from the area F to the area C in fig. 1 passes through a series of other areas, and each passage from one area into a contiguous area corresponds to a line drawn in the diagram of stress. Hence the whole path from F

to C in fig. 1 corresponds to a path formed of lines in fig. 2 and extending from F to C, and the resultant of all the stresses in the links cut by the path is represented by FC in fig. 2.

Many examples of stress diagrams are given in the article on bridges (*q.v.*).

Automatic Description of Diagrams.

There are many other kinds of diagrams in which the two co-ordinates of a point in a plane are employed to indicate the simultaneous values of two related quantities. If a sheet of paper is made to move, say horizontally, with a constant known velocity, while a tracing point is made to move in a vertical straight line, the height varying as the value of any given physical quantity, the point will trace out a curve on the paper from which the value of that quantity at any given time may be determined. This principle is applied to the automatic registration of phenomena of all kinds, from those of meteorology and terrestrial magnetism to the velocity of cannon-shot, the vibrations of sounding bodies, the motions of animals, voluntary and involuntary, and the currents in electric telegraphs.

In Watt's indicator for steam engines the paper does not move with a constant velocity, but its displacement is proportional to that of the piston of the engine, while that of the tracing point is proportional to the pressure of the steam. Hence the co-ordinates of a point of the curve traced on the diagram represent the volume and the pressure of the steam in the cylinder. The indicator-diagram not only supplies a record of the pressure of the steam at each stage of the stroke of the engine, but indicates the work done by the steam in each stroke by the area enclosed by the curve traced on the diagram. (J. C. M.)

DIAL and DIALLING. Dialling, sometimes called gnomonics, is a branch of applied mathematics which treats of the construction of sun-dials, that is, of those instruments, either fixed or portable, which determine the divisions of the day (Lat. *dies*) by the motion of the shadow of some object on which the sun's rays fall. It must have been one of the earliest applications of a knowledge of the apparent motion of the sun; though for a long time men would probably be satisfied with the division into morning and afternoon as marked by sun-rise, sun-set and the greatest elevation.

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The dial of Berossus remained in use for centuries. The Arabians, as appears from the work of Albategnius, still followed the same construction about the year A.D. 900. Four of these dials have in modern times been found in Italy. One, discovered at Tivoli in 1746, is supposed to have belonged to Cicero, who, in one of his letters, says that he had sent a dial of this kind to his villa near Tusculum. The second and third were found in 1751—one at Castel-Nuovo and the other at Rignano; and a fourth was found in 1762 at Pompeii. G. H. Martini in his *Abhandlungen von den Sonnenuhren der Alten* (Leipzig, 1777), says that this dial was made for the latitude of Memphis; it may therefore be the work of Egyptians, perhaps constructed in the school of Alexandria.

Herodotus recorded that the Greeks derived from the Babylonians the use of the gnomon, but the great progress made by the Greeks in geometry enabled them in later times to construct dials of great complexity, some of which remain to us, and are proof not only of extensive knowledge but also of great ingenuity.

Ptolemy's *Almagest* treats of the construction of dials by means of his *analemma*, an instrument which solved a variety of astronomical problems. The constructions given by him were sufficient for regular dials, that is, horizontal dials, or vertical dials facing east, west, north or south, and these are the only ones he treats of. It is certain, however, that the ancients were able to construct declining dials, as is shown by that most interesting monument of ancient gnomics—the Tower of the Winds at Athens. This is a regular octagon, on the faces of which the eight principal winds are represented, and over them eight different dials—four facing the cardinal points and the other four facing the intermediate directions. The date of the dials is long subsequent to that of the tower; for Vitruvius, who describes the tower in the sixth chapter of his first book, says nothing about the dials, and as he has described all the dials known in his time, we must believe that the dials of the tower did not then exist. The hours are still the temporary hours or, as the Greeks called them, *hectemoria*.

The first sun-dial erected at Rome was in the year 290 B.C., and this Papirius Cursor had taken from the Samnites. A dial which Valerius Messalla had brought from Catania, the latitude of which is five degrees less than that of Rome, was placed in the forum in the year 261 B.C. The first dial actually constructed at Rome was in the year 164 B.C., by order of Q. Marcius Philippus, but as no other Roman has written on gnomonics, this was perhaps the work of a foreign artist. If, too, we remember that the dial found at Pompeii was made for the latitude of Memphis, and consequently less adapted to its position than that of Catania to Rome, we may infer that mathematical knowledge was not cultivated in Italy.

The Arabians were much more successful. They attached great importance to gnomonics, the principles of which they had learned from the Greeks, but they greatly simplified and diversified the Greek constructions. One of their writers, Abu'l Hassan, who lived about the beginning of the 13th century, taught them how to trace dials on cylindrical, conical and other surfaces. He even introduced *equal* or *equinoctial hours*, but the idea was not supported, and the temporary hours alone continued in use.

Where or when the great and important step already conceived by Abu'l Hassan, and perhaps by others, of reckoning by *equal* hours was generally adopted cannot now be determined. The history of gnomonics from the 13th to the beginning of the 16th century is almost a blank, and during that time the change took place. We can see, however, that the change would necessarily follow the introduction of clocks and other mechanical methods of measuring time; for, however imperfect these were, the hours they marked would be of the same length in summer and in winter, and the discrepancy between these equal hours and the temporary hours of the sun-dial would soon be too important to be overlooked. Now, we know that a balance clock was put up in the palace of Charles V. of France about the year 1370, and we may reasonably suppose that the new sun-dials came into general use during the 14th and 15th centuries.

Among the earliest of the modern writers on gnomonics was Sebastian Münster (*q.v.*), who published his *Horologiographia* at Basel in 1531. He gives a number of correct rules, but without demonstrations. Among his inventions was a moon-dial,[1] but this does not admit of much accuracy.

During the 17th century dialling was discussed at great length by many writers on astronomy. Clavius devotes a quarto

[1] In one of the courts of Queens' College, Cambridge, there is an elaborate sun-dial dating from the end of the 17th or beginning of the 18th century, and around it a series of numbers which make it available as a moon-dial when the moon's age is known.

volume of 800 pages entirely to the subject. This was published in 1612, and may be considered to contain all that was known at that time.

In the 18th century clocks and watches began to supersede sun-dials, and these have gradually fallen into disuse except as an additional ornament to a garden, or in remote country districts where the old dial on the church tower still serves as an occasional check on the modern clock by its side. The art of constructing dials may now be looked upon as little more than a mathematical recreation.

General Principles.—The diurnal and the annual motions of the earth are the elementary astronomical facts on which dialling is founded. That the earth turns upon its axis uniformly from west to east in twenty-four hours, and that it is carried round the sun in one year at a nearly uniform rate, is the correct way of expressing these facts. But the effect will be precisely the same, and it will suit our purpose better, and make our explanations easier, if we adopt the ideas of the ancients, of which our senses furnish apparent confirmation, and assume the earth to be fixed. Then, the sun and stars revolve round the earth's axis uniformly from east to west once a day—the sun lagging a little behind the stars, making its day some four minutes longer—so that at the end of the year it finds itself again in the same place, having made a complete revolution of the heavens relatively to the stars from west to east.

The fixed axis about which all these bodies revolve daily is a line through the earth's centre; but the radius of the earth is so small, compared with the enormous distance of the sun, that, if we draw a parallel axis through any point of the earth's surface, we may safely look on that as being the axis of the celestial motions. The error in the case of the sun would not, at its maximum, that is, at 6 A.M. and 6 P.M., exceed half a second of time, and at noon would vanish. An axis so drawn is in the plane of the meridian, and points to the pole, its elevation being equal to the latitude of the place.

The diurnal motion of the stars is strictly uniform, and so would that of the sun be if the daily retardation of about four minutes, spoken of above, were always the same. But this is constantly altering, so that the time, as measured by the sun's motion, and also consequently as measured by a sun-dial, does not move on at a strictly uniform pace. This irregularity, which is slight, would be of little consequence in the ordinary affairs of life, but clocks and watches being mechanical measures of time could not, except by extreme complication, be made to follow this irregularity, even if desirable.

The clock is constructed to mark uniform time in such wise that the length of the clock day shall be the average of all the solar days in the year. Four times a year the clock and the sun-dial agree exactly; but the sun-dial, now going a little slower, now a little faster, will be sometimes behind, sometimes before the clock—the greatest accumulated difference being about sixteen minutes for a few days in November, but on the average much less. The four days on which the two agree are April 15, June 15, September 1 and December 24.

Clock-time is called *mean time*, that marked by the sun-dial is called *apparent time*, and the difference between them is the *equation of time*. It is given in most calendars and almanacs, frequently under the heading "clock slow," "clock fast." When the time by the sun-dial is known, the equation of time will at once enable us to obtain the corresponding clock-time, or vice versa.

Atmospheric refraction introduces another error by altering the apparent position of the sun; but the effect is too small to need consideration in the construction of an instrument which, with the best workmanship, does not after all admit of very great accuracy.

The general principles of dialling will now be readily understood. The problem before us is the following:—A rod, or *style*, as it is called, being firmly fixed in a direction parallel to the earth's axis, we have to find how and where points or lines of reference must be traced on some fixed surface behind the style, so that when the shadow of the style falls on a certain one of these lines, we may know that at that moment it is solar noon,—that is, that the plane through the style and through the sun then coincides with the meridian; again, that when the shadow reaches the next line of reference, it is 1 o'clock by solar time, or, which comes to the same thing, that the above plane through the style and through the sun has just turned through the twenty-fourth part of a complete revolution; and so on for the subsequent hours,—the hours before noon being indicated in a similar manner. The style and the surface on which these lines are traced together constitute the dial.

The position of an intended sun-dial having been selected—whether on church tower, south front of farmstead or garden wall—the surface must be prepared, if necessary, to receive the hour-lines.

The chief, and in fact the only practical difficulty will be the accurate fixing of the style, for on its accuracy the value of the instrument depends. It must be in the meridian plane, and must make an angle with the horizon equal to the latitude of the place. The latter condition will offer no difficulty, but the exact determination of the meridian plane which passes through the point where the style is fixed to the surface is not so simple. At present we shall assume that the style has been fixed in its true position. The style itself will be usually a stout metal wire, and when we speak of the shadow cast by the style it must always be understood that the middle line of the thin band of shade is meant.

The point where the style meets the dial is called the centre of the dial. It is the centre from which all the hour-lines radiate.

The position of the XII o'clock line is the most important to determine accurately, since all the others are usually made to depend on this one. We cannot trace it correctly on the dial until the style has been itself accurately fixed in its proper place. When that is done the XII o'clock line will be found by the intersection of the dial surface with the vertical plane which contains the style; and the most simple way of drawing it on the dial will be by suspending a plummet from some point of the style whence it may hang freely, and waiting until the shadows of both style and plumb-line coincide on the dial. This single shadow will be the XII o'clock line.

In one class of dials, namely, all the vertical ones, the XII o'clock line is simply the vertical line from the centre; it can, therefore, at once be traced on the dial face by using a fine plumb-line.

The XII o'clock line being traced, the easiest and most accurate method of tracing the other hour-lines would, at the present day when good watches are common, be by marking where the shadow of the style falls when 1, 2, 3, &c., hours have elapsed since noon, and the next morning by the same means the forenoon hour-lines could be traced; and in the same manner the hours might be subdivided into halves and quarters, or even into minutes.

But formerly, when watches did not exist, the tracing of the I, II, III, &c., o'clock lines was done by calculating the angle which each of these lines would make with the XII o'clock line. Now, except in the simple cases of a horizontal dial or of a vertical dial facing a cardinal point, this would require long and intricate calculations, or elaborate geometrical constructions, implying considerable mathematical knowledge, but also introducing increased chances of error. The chief source of error would lie in the uncertainty of the data; for the position of the dial-plane would have to be found before the calculations began,—that is, it would be necessary to know exactly by how many degrees it declined from the south towards the east or west, and by how many degrees it inclined from the vertical. The ancients, with the means at their disposal, could obtain these results only very roughly.

Dials received different names according to their position:—

Horizontal dials, when traced on a horizontal plane;

Vertical dials, when on a vertical plane facing one of the cardinal points;

Vertical declining dials, on a vertical plane not facing a cardinal point;

Inclining dials, when traced on planes neither vertical nor horizontal (these were further distinguished as *reclining* when leaning backwards from an observer, *proclining* when leaning forwards);

Equinoctial dials, when the plane is at right angles to the earth's axis, &c. &c.

Dial Construction.—A very correct view of the problem of dial construction may be obtained as follows:—

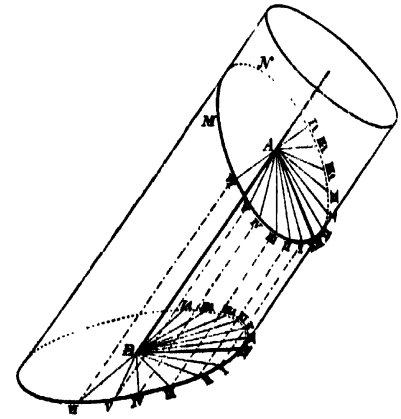

FIG. 1.

Conceive a transparent cylinder (fig. 1) having an axis AB parallel to the axis of the earth. On the surface of the cylinder let equidistant generating lines be traced 15° apart, one of them XII . . . XII being in the meridian plane through AB, and the others I . . . I, II . . . II, &c., following in the order of the sun's motion.

Then the shadow of the line AB will obviously fall on the line XII . . . XII at apparent noon, on the line I . . . I at one hour after noon, on II . . . II at two hours after noon, and so on. If now the cylinder be cut by any plane MN representing the plane on which the dial is to be traced, the shadow of AB will be intercepted by this plane and fall on the lines AXII AI, AII, &c.

The construction of the dial consists in determining the angles made

to C in fig. 1 corresponds to a path formed of lines in fig. 2 and extending from F to C, and the resultant of all the stresses in the links cut by the path is represented by FC in fig. 2.

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DIAL and DIALLING. Dialling, sometimes called gnomonics, is a branch of applied mathematics which treats of the construction of sun-dials, that is, of those instruments, either fixed or portable, which determine the divisions of the day (Lat. *dies*) by the motion of the shadow of some object on which the sun's rays fall. It must have been one of the earliest applications of a knowledge of the apparent motion of the sun; though for a long time men would probably be satisfied with the division into morning and afternoon as marked by sun-rise, sun-set and the greatest elevation.

History.—The earliest mention of a sun-dial is found in Isaiah xxxviii. 8: "Behold, I will bring again the shadow of the degrees which is gone down in the *sun-dial* of Ahaz ten degrees backward." The date of this would be about 700 years before the Christian era, but we know nothing of the character or construction of the instrument. The earliest of all sun-dials of which we have any certain knowledge was the hemicycle, or hemisphere, of the Chaldaean astronomer Berossus, who probably lived about 300 B.C. It consisted of a hollow hemisphere placed with its rim perfectly horizontal, and having a bead, or globule, fixed in any way at the centre. So long as the sun remained above the horizon the shadow of the bead would fall on the inside of the hemisphere, and the path of the shadow during the day would be approximately a circular arc. This arc, divided into twelve equal parts, determined twelve equal intervals of time for that day. Now, supposing this were done at the time of the solstices and equinoxes, and on as many intermediate days as might be considered sufficient, and then curve lines drawn through the corresponding points of division of the different arcs, the shadow of the bead falling on one of these curve lines would mark a division of time for that day, and thus we should have a sun-dial which would divide each period of daylight into twelve equal parts. These equal parts were called *temporary hours*; and, since the duration of daylight varies from day to day, the temporary hours of one day would differ from those of another; but this inequality would probably be disregarded at that time, and especially in countries where the variation between the longest summer day and the shortest winter day is much less than in our climates.

The dial of Berossus remained in use for centuries. The Arabians, as appears from the work of Albategnius, still followed the same construction about the year A.D. 900. Four of these dials have in modern times been found in Italy. One, discovered at Tivoli in 1746, is supposed to have belonged to Cicero, who, in one of his letters, says that he had sent a dial of this kind to his villa near Tusculum. The second and third were found in 1751—one at Castel-Nuovo and the other at Rignano; and a fourth was found in 1762 at Pompeii. G. H. Martini in his *Abhandlungen von den Sonnenuhren der Alten* (Leipzig, 1777), says that this dial was made for the latitude of Memphis; it may therefore be the work of Egyptians, perhaps constructed in the school of Alexandria.

Herodotus recorded that the Greeks derived from the Babylonians the use of the gnomon, but the great progress made by the Greeks in geometry enabled them in later times to construct dials of great complexity, some of which remain to us, and are proof not only of extensive knowledge but also of great ingenuity.

Ptolemy's *Almagest* treats of the construction of dials by means of his *analemma*, an instrument which solved a variety of astronomical problems. The constructions given by him were sufficient for regular dials, that is, horizontal dials, or vertical dials facing east, west, north or south, and these are the only ones he treats of. It is certain, however, that the ancients were able to construct declining dials, as is shown by that most interesting monument of ancient gnomics—the Tower of the Winds at Athens. This is a regular octagon, on the faces of which the eight principal winds are represented, and over them eight different dials—four facing the cardinal points and the other four facing the intermediate directions. The date of the dials is long subsequent to that of the tower; for Vitruvius, who describes the tower in the sixth chapter of his first book, says nothing about the dials, and as he has described all the dials known in his time, we must believe that the dials of the tower did not then exist. The hours are still the temporary hours or, as the Greeks called them, *hectemoria*.

The first sun-dial erected at Rome was in the year 290 B.C., and this Papirius Cursor had taken from the Samnites. A dial which Valerius Messalla had brought from Catania, the latitude of which is five degrees less than that of Rome, was placed in the forum in the year 261 B.C. The first dial actually constructed at Rome was in the year 164 B.C., by order of Q. Marcius Philippus, but as no other Roman has written on gnomonics, this was perhaps the work of a foreign artist. If, too, we remember that the dial found at Pompeii was made for the latitude of Memphis, and consequently less adapted to its position than that of Catania to Rome, we may infer that mathematical knowledge was not cultivated in Italy.

The Arabians were much more successful. They attached great importance to gnomonics, the principles of which they had learned from the Greeks, but they greatly simplified and diversified the Greek constructions. One of their writers, Abu'l Hassan, who lived about the beginning of the 13th century, taught them how to trace dials on cylindrical, conical and other surfaces. He even introduced *equal* or *equinoctial hours*, but the idea was not supported, and the temporary hours alone continued in use.

Where or when the great and important step already conceived by Abu'l Hassan, and perhaps by others, of reckoning by *equal* hours was generally adopted cannot now be determined. The history of gnomonics from the 13th to the beginning of the 16th century is almost a blank, and during that time the change took place. We can see, however, that the change would necessarily follow the introduction of clocks and other mechanical methods of measuring time; for, however imperfect these were, the hours they marked would be of the same length in summer and in winter, and the discrepancy between these equal hours and the temporary hours of the sun-dial would soon be too important to be overlooked. Now, we know that a balance clock was put up in the palace of Charles V. of France about the year 1370, and we may reasonably suppose that the new sun-dials came into general use during the 14th and 15th centuries.

Among the earliest of the modern writers on gnomonics was Sebastian Münster (*q.v.*), who published his *Horologiographia* at Basel in 1531. He gives a number of correct rules, but without demonstrations. Among his inventions was a moon-dial,[1] but this does not admit of much accuracy.

During the 17th century dialling was discussed at great length by many writers on astronomy. Clavius devotes a quarto

[1] In one of the courts of Queens' College, Cambridge, there is an elaborate sun-dial dating from the end of the 17th or beginning of the 18th century, and around it a series of numbers which make it available as a moon-dial when the moon's age is known.

meridian. Through E, the centre of the sphere, draw a vertical plane facing south. This will cut the sphere in the great circle ZMA, which, being vertical, will pass through the zenith, and, facing south, will be at right angles to the meridian. Let QMs be the equatorial circle, obtained by drawing a plane through E at right angles to the axis PEp. The lower portion Ep of the axis will be the style, the vertical line EA in the meridian plane will be the XII o'clock line, and the line EM, which is obviously horizontal, since M is the intersection of two great circles ZM, QM, each at right angles to the vertical plane QZP, will be the VI o'clock line. Now, as in the previous problem, divide the equatorial circle into 24 equal arcs of 15° each, beginning at *a*, viz. *ab*, *bc*, &c.,—each quadrant aM, MQ, &c., containing 6,—then through each point of division and through the

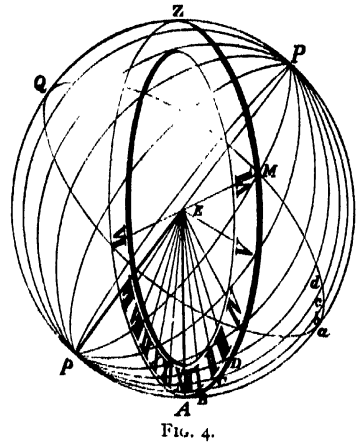


FIG. 4.

axis Pp draw a plane cutting the sphere in 24 equidistant great circles. As the sun revolves round the axis the shadow of the axis will successively fall on these circles at intervals of one hour, and if these circles cross the vertical circle ZMA in the points A, B, C, &c., the shadow of the lower portion Ep of the axis will fall on the lines EA, EB, EC, &c., which will therefore be the required hour-lines on the vertical dial, Ep being the style.

There is no necessity for going beyond the VI o'clock hour-line on each side of noon; for, in the winter months the sun sets earlier than 6 o'clock, and in the summer months it passes behind the plane of the dial before that time, and is no longer available.

It remains to show how the angles AEB, AEC, &c., may be calculated.

The spherical triangles pAB, pAC, &c., will give us a simple rule. These triangles are all right-angled at A, the side pA, equal to ZP, is the co-latitude of the place, that is, the difference between the latitude and 90°; and the successive angles ApB, ApC, &c., are 15°, 30°, &c., respectively. Then

$$\tan AB = \tan 15^\circ \sin \textit{co-latitude};$$

or more simply,

$$\tan AB = \tan 15^\circ \cos \textit{latitude},$$
$$\tan AC = \tan 30^\circ \cos \textit{latitude},$$
&c. &c.

and the arcs AB, AC so found are the measure of the angles AEB, AEC, &c., required.

In this case the angles diminish as the latitudes increase, the opposite result to that of the horizontal dial.

Inclining, Reclining, &c., Dials.—We shall not enter into the calculation of these cases. Our imaginary sphere being, as before supposed, constructed with its centre at the centre of the dial, and all the hour-circles traced upon it, the intersection of these hour-circles with the plane of the dial will determine the hour-lines just as in the previous cases; but the triangles will no longer be right-angled, and the simplicity of the calculation will be lost, the chances of error being greatly increased by the difficulty of drawing the dial plane in its true position on the sphere, since that true position will have to be found from observations which can be only roughly performed.

In all these cases, and in cases where the dial surface is not a plane, and the hour-lines, consequently, are not straight lines, the only safe practical way is to mark rapidly on the dial a few points (one is sufficient when the dial face is plane) of the shadow at the moment when a good watch shows that the hour has arrived, and afterwards connect these points with the centre by a continuous line. Of course the style must have been accurately fixed in its true position before we begin.

Equatorial Dial.—The name equatorial dial is given to one whose plane is at right angles to the style, and therefore parallel to the equator. It is the simplest of all dials. A circle (fig. 5) divided into 24 equal arcs is placed at right angles to the style, and hour divisions are marked upon it. Then if care be taken that the style point accurately to the pole, and that the noon division coincide with the meridian plane, the shadow of the style will fall on the other divisions, each at its proper time. The divisions must be marked on both sides of the dial, because the sun will shine on opposite sides in the summer and in the winter months, changing at each equinox.

To find the Meridian Plane.—We have, so far, assumed the meridian plane to be accurately known; we shall proceed to describe some of the methods by which it may be found.

The mariner's compass may be employed as a first rough approximation. It is well known that the needle of the compass, when free to move horizontally, oscillates upon its pivot and settles in a direction termed the magnetic meridian. This does not coincide with the true north and south line, but the difference between them is generally known with tolerable accuracy, and is called the variation of the compass. The variation differs widely at different parts of the surface of the earth, and is not stationary at any particular place, though the change is slow; and there is even a small daily oscillation which takes place about the mean position, but too small to need notice here (see MAGNETISM, TERRESTRIAL).

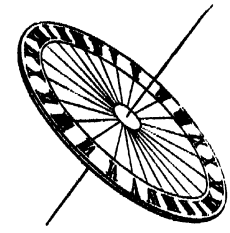


FIG. 5.

With all these elements of uncertainty, it is obvious that the compass can only give a rough approximation to the position of the meridian, but it will serve to fix the style so that only a small further alteration will be necessary when a more perfect determination has been made.

A very simple practical method is the following:—

Place a table (fig. 6), or other plane surface, in such a position that it may receive the sun's rays both in the morning and in the afternoon. Then carefully level the surface by means of a spirit-level. This must be done very accurately, and the table in that position made perfectly secure, so that there be no danger of its shifting during the day.

Next, suspend a plummet SH from a point S, which must be rigidly fixed. The extremity H, where the plummet just meets the surface, should be somewhere near the middle of one end of the table. With H for centre, describe any number of concentric arcs of circles, AB, CD, EF, &c.

A bead P, kept in its place by friction, is threaded on the plummet line at some convenient height above H.

Everything being thus prepared, let us follow the shadow of the bead P as it moves along the surface of the table during the day. It will be found to describe a curve ACE . . . FDB, approaching the point H as the sun advances towards noon, and receding from it afterwards. (The curve is a conic section—an hyperbola in these regions.) At the moment when it crosses the arc AB, mark the point A; AP is then the direction of the sun, and, as AH is horizontal, the angle PAH is the altitude of the sun. In the afternoon mark the point B where it crosses the same arc; then the angle PBH is the altitude. But the right-angled triangles PHA, PHB are obviously equal; and the sun has therefore the same altitudes at those two instants, the one before, the other after noon. It follows that, *if the sun has not changed its declination* during the interval, the two positions will be symmetrically placed one on each side of the meridian. Therefore, drawing the chord AB, and bisecting it in M, HM will be the meridian line.

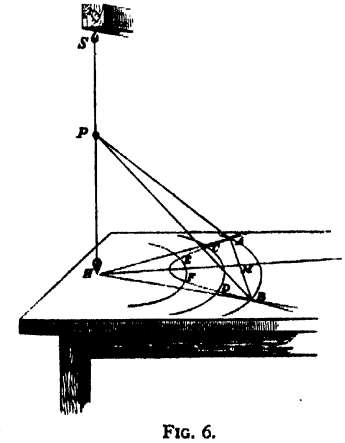


FIG. 6.

Each of the other concentric arcs, CD, EF, &c., will furnish its meridian line. Of course these should all coincide, but if not, the mean of the positions thus found must be taken.

The proviso mentioned above, that the sun has not changed its declination, is scarcely ever realized; but the change is slight, and may be neglected, except perhaps about the time of the equinoxes, at the end of March and at the end of September. Throughout the remainder of the year the change of declination is so slow that we may safely neglect it. The most favourable times are at the end of June and at the end of December, when the sun's declination is almost stationary. If the line HM be produced both ways to the edges of the table, then the two points on the ground vertically below those on the edges may be found by a plummet, and, if permanent marks be made there, the meridian plane, which is the vertical plane passing through these two points, will have its position perfectly secured

To place the Style of a Dial in its True Position.—Before giving any other method of finding the meridian plane, we shall complete the construction of the dial, by showing how the style may now be accurately placed in its true position. The angle which the style makes with a hanging plumb-line, being the co-latitude of the place, is known, and the north and south direction is also roughly given by the mariner's compass. The style may therefore be already adjusted approximately—correctly, indeed, as to its inclination—but probably requiring a little horizontal motion east or west. Suspend a fine plumb-line from some point of the style, then the style will be properly adjusted if, at the very instant of noon, its shadow falls exactly on the plumb-line,—or, which is the same thing, if both shadows coincide on the dial.

This instant of noon will be given very simply, by the meridian plane, whose position we have secured by the two permanent marks on the ground. Stretch a cord from the one mark to the other. This will not generally be horizontal, but the cord will be wholly in the meridian plane, and that is the only necessary condition. Next, suspend a plummet over the mark which is nearer to the sun, and, when the shadow of the plumb-line falls on the stretched cord, it is noon. A signal from the observer there to the observer at the dial enables the latter to adjust the style as directed above.

Other Methods of finding the Meridian Plane.—We have dwelt at some length on these practical operations because they are simple and tolerably accurate, and because they want neither watch, nor sextant, nor telescope—nothing more, in fact, than the careful observation of shadow lines.

The Pole star, or *Ursae Minoris*, may also be employed for finding the meridian plane without other apparatus than plumb-lines. This star is now only about 1° 14′ from the pole; if therefore a plumb-line be suspended at a few feet from the observer, and if he shift his position till the star is exactly hidden by the line, then the plane through his eye and the plumb-line will never be far from the meridian plane. Twice in the course of the twenty-four hours the planes would be strictly coincident. This would be when the star crosses the meridian above the pole, and again when it crosses it below. If we wished to employ the method of determining the meridian, the times of the stars crossing would have to be calculated from the data in the *Nautical Almanac*, and a watch would be necessary to know when the instant arrived. The watch need not, however, be very accurate, because the motion of the star is so slow that an error of ten minutes in the time would not give an error of one-eighth of a degree in the azimuth.

The following accidental circumstance enables us to dispense with both calculation and watch. The right ascension of the star *η Ursae Majoris*, that star in the tail of the Great Bear which is farthest from the "pointers," happens to differ by a little more than 12 hours from the right ascension of the Pole star. The great circle which joins the two stars passes therefore close to the pole. When the Pole star, at a distance of about 1° 14′ from the pole, is crossing the meridian above the pole, the star *η Ursae Majoris*, whose polar distance is about 40°, has not yet reached the meridian below the pole.

When *η Ursae Majoris* reaches the meridian, which will be within half an hour later, the Pole star will have left the meridian; but its slow motion will have carried it only a very little distance away. Now at some instant between these two times—much nearer the latter than the former—the great circle joining the two stars will be exactly vertical; and at this instant, which the observer determines by seeing that the plumb-line hides the two stars simultaneously, neither of the stars is strictly in the meridian; but the deviation from it is so small that it may be neglected, and the plane through the eye and the plumb-line taken for meridian plane.

In all these cases it will be convenient, instead of fixing the plane by means of the eye and one fixed plummet, to have a second plummet at a short distance in front of the eye; this second plummet, being suspended so as to allow of lateral shifting, must be moved so as always to be between the eye and the fixed plummet. The meridian plane will be secured by placing two permanent marks on the ground, one under each plummet.

This method, by means of the two stars, is only available for the upper transit of *Polaris*; for, at the lower transit, the other star *η Ursae Majoris* would pass close to or beyond the zenith, and the observation could not be made. Also the stars will not be visible when the upper transit takes place in the daytime, so that one-half of the year is lost to this method.

Neither could it be employed in lower latitudes than 40° N., for there the star would be below the horizon at its lower transit;—we may even say not lower than 45° N., for the star must be at least 5° above the horizon before it becomes distinctly visible.

There are other pairs of stars which could be similarly employed, but none so convenient as these two, on account of *Polaris* with its very slow motion being one of the pair.

To place the Style in its True Position without previous Determination of the Meridian Plane.—The various methods given above for finding the meridian plane have for ultimate object the determination of the plane, not on its own account, but as an element for fixing the instant of noon, whereby the style may be properly placed.

We shall dispense, therefore, with all this preliminary work if we determine noon by astronomical observation. For this we shall want a good watch, or pocket chronometer, and a sextant or other instrument for taking altitudes. The local time at any moment may be determined in a variety of ways by observation of the celestial bodies. The simplest and most practically useful methods will be found described and investigated in any work on astronomy.

For our present purpose a single altitude of the sun taken in the forenoon will be most suitable. At some time in the morning, when the sun is high enough to be free from the mists and uncertain refractions of the horizon—but to ensure accuracy, while the rate of increase of the altitude is still tolerably rapid, and, therefore, not later than 10 o'clock—take an altitude of the sun, an assistant, at the same moment, marking the time shown by the watch. The altitude so observed being properly corrected for refraction, parallax, &c., will, together with the latitude of the place, and the sun's declination, taken from the *Nautical Almanac*, enable us to calculate the time. This will be the solar or apparent time, that is, the very time we require. Comparing the time so found with the time shown by the watch, we see at once by how much the watch is fast or slow of solar time; we know, therefore, exactly what time the watch must mark when solar noon arrives, and waiting for that instant we can fix the style in its proper position as explained before.

We can dispense with the sextant and with all calculation and observation if, by means of the pocket chronometer, we bring the time from some observatory where the work is done; and, allowing for the change of longitude, and also for the equation of time, if the time we have brought is clock time, we shall have the exact instant of solar noon as in the previous case.

In former times the fancy of dialists seems to have run riot in devising elaborate surfaces on which the dial was to be traced. Sometimes the shadow was received on a cone, sometimes on a cylinder, or on a sphere, or on a combination of these. A universal dial was constructed of a figure in the shape of a cross; another universal dial showed the hours by a globe and by several gnomons. These universal dials required adjusting before use, and for this a mariner's compass and a spirit-level were necessary. But it would be tedious and useless to enumerate the various forms designed, and, as a rule, the more complex the less accurate.

Another class of useless dials consisted of those with variable centres. They were drawn on fixed horizontal planes, and each day the style had to be shifted to a new position. Instead of hour-*lines* they had hour-*points*; and the style, instead of being parallel to the axis of the earth, might make any chosen angle with the horizon. There was no practical advantage in their use, but rather the reverse; and they can only be considered as furnishing material for new mathematical problems.

Portable Dials.—The dials so far described have been fixed dials, for even the fanciful ones to which reference was just now made were to be fixed before using. There were, however, other dials, made generally of a small size, so as to be carried in the pocket; and these, so long as the sun shone, roughly answered the purpose of a watch.

The description of the portable dial has generally been mixed up with that of the fixed dial, as if it had been merely a special case, and the same principle had been the basis of both; whereas there are essential points of difference between them, besides those which are at once apparent.

In the fixed dial the result depends on the *uniform* angular motion of the sun round the fixed style; and a small error in the assumed position of the sun, whether due to the imperfection of the instrument, or to some small neglected correction, has only a trifling effect on the time. This is owing to the angular displacement of the sun being so rapid—a quarter of a degree every minute—that for the ordinary affairs of life greater accuracy is not required, as a displacement of a quarter of a degree, or at any rate of one degree, can be readily seen by nearly every person. But with a portable dial this is no longer the case. The uniform angular motion is not now available, because we have no determined fixed plane to which we may refer it. In the new position, to which the observer has gone, the zenith is the only point of the heavens he can at once practically find; and the basis for the determination of the time is the constantly but *very irregularly* varying zenith distance of the sun.

At sea the observation of the altitude of a celestial body is the only method available for finding local time; but the perfection which has been attained in the construction of the sextant enables the sailor to reckon on an accuracy of seconds. Certain precautions have, however, to be taken. The observations must not be made within a couple of hours of noon, on account of the slow rate of change at that time, nor too near the horizon, on account of the uncertain refractions there; and the same restrictions must be observed in using a portable dial.

To compare roughly the accuracy of the fixed and the portable dials, let us take a mean position in Great Britain, say 54° lat., and a mean declination when the sun is in the equator. It will rise at 6 o'clock, and at noon have an altitude of 36°,—that is, the portable dial will indicate an average change of one-tenth of a degree in each minute, or two and a half times slower than the fixed dial. The vertical motion of the sun increases, however, nearer the horizon, but even there it will be only one-eighth of a degree each minute, or half the rate of the fixed dial, which goes on at nearly the same speed throughout the day.

Portable dials are also much more restricted in the range of latitude

for which they are available, and they should not be used more than 4 or 5 m. north or south of the place for which they were constructed.

We shall briefly describe two portable dials which were in actual use.

Dial on a Cylinder.—A hollow cylinder of metal (fig. 7), 4 or 5 in. high, and about an inch in diameter, has a lid which admits of tolerably easy rotation. A hole in the lid receives the style, shaped somewhat like a bayonet; and the straight part of the style, which, on account of the two bends, is lower than the lid, projects horizontally out from the cylinder to a distance of 1 or 1½ in. When not in use the style would be taken out and placed inside the cylinder.

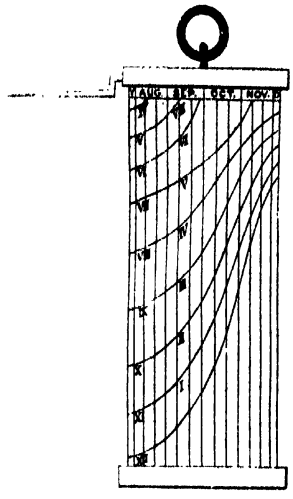


FIG. 7.

A horizontal circle is traced on the cylinder opposite the projecting style, and this circle is divided into 36 approximately equidistant intervals.[1] These intervals represent spaces of time, and to each division is assigned a date, so that each month has three dates marked as follows:—January 10, 20, 31; February 10, 20, 28; March 10, 20, 31; April 10, 20, 30, and so on,—always the 10th, the 20th, and the last day of each month.

Through each point of division a vertical line parallel to the axis of the cylinder is drawn from top to bottom. Now it will be readily understood that if, upon one of these days, the lid be turned, so as to bring the style exactly opposite the date, and if the dial be then placed on a horizontal table so as to receive sunlight, and turned round *bodily* until the shadow of the style falls exactly on the vertical line below it, the shadow will terminate at some definite point of this line, the position of which point will depend on the length of the style—that is, the distance of its end from the surface of the cylinder—and on the altitude of the sun at that instant. Suppose that the observations are continued all day, the cylinder being very gradually turned so that the style may always face the sun, and suppose that marks are made on the vertical line to show the extremity of the shadow at each exact hour from sunrise to sunset—these times being taken from a good fixed sun-dial,—then it is obvious that the next year, on the *same date*, the sun's declination being about the same, and the observer in about the same latitude, the marks made the previous year will serve to tell the time all that day.

What we have said above was merely to make the principle of the instrument clear, for it is evident that this mode of marking, which would require a whole year's sunshine and hourly observation, cannot be the method employed.

The positions of the marks are, in fact, obtained by calculation. Corresponding to a given date, the declination of the sun is taken from the almanac, and this, together with the latitude of the place and the length of the style, will constitute the necessary data for computing the length of the shadow, that is, the distance of the mark below the style for each successive hour.

We have assumed above that the declination of the sun is the same at the same date in different years. This is not quite correct, but, if the dates be taken for the second year after leap year, the results will be sufficiently approximate.

When all the hour-marks have been placed opposite to their respective dates, then a continuous curve, joining the corresponding hour-points, will serve to find the time for a day intermediate to those set down, the lid being turned till the style occupy a proper position between the two divisions. The horizontality of the surface on which the instrument rests is a very necessary condition, especially in summer, when, the shadow of the style being long, the extreme end will shift rapidly for a small deviation from the vertical, and render the reading uncertain. The dial can also be used by holding it up by a small ring in the top of the lid, and probably the verticality is better ensured in that way.

Portable Dial on a Card.—This neat and very ingenious dial is attributed by Ozanam to a Jesuit Father, De Saint Rigaud, and probably dates from the early part of the 17th century. Ozanam says that it was sometimes called the *capuchin*, from some fancied resemblance to a cowl thrown back.

Construction.—Draw a straight line ACB parallel to the top of the card (fig. 8) and another DCE at right angles to it; with C as centre, and any convenient radius CA, describe the semicircle AEB below the horizontal. Divide the whole arc AEB into 12 equal parts at the points *r*, *s*, *t*, &c., and through these points draw perpendiculars to the diameter ACB; these lines will be the hour-lines, viz. the line through *r* will be the XI . . . I line, the line through *s* the X . . . II line, and so on; the hour-line of noon will be the point A itself; by subdivision of the small arcs A*r*, *rs*, *st*, &c., we may draw the hour-lines corresponding to halves and quarters, but this only where it can be done without confusion.

Draw ASD making with AC an angle equal to the latitude of the place, and let it meet EC in D, through which point draw FDG at right angles to AD.

With centre A, and any convenient radius AS, describe an arc of circle RST, and graduate this arc by marking degree divisions on

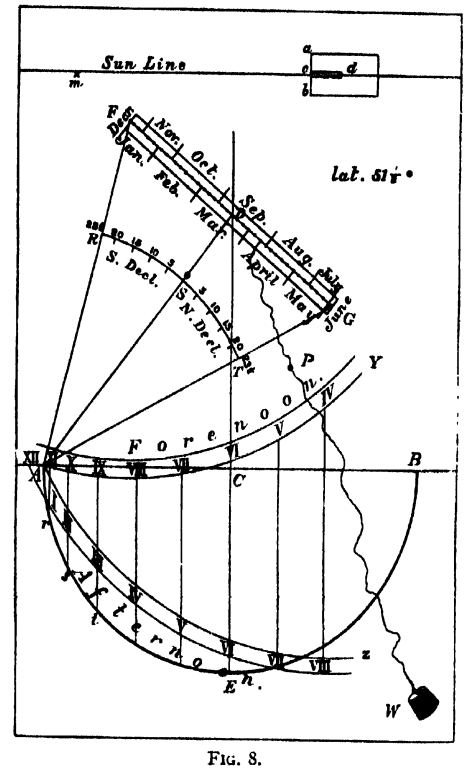


FIG. 8.

it, extending from 0° at S to 23½° on each side at R and T. Next determine the points on the straight line FDG where radii drawn from A to the degree divisions on the arc would cross it, and carefully mark these crossings.

The divisions of RST are to correspond to the sun's declination, south declinations on RS and north declinations on ST. In the other hemisphere of the earth this would be reversed; the north declinations would be on the upper half.

Now, taking a second year after leap year (because the declinations of that year are about the mean of each set of four years), find the days of the month when the sun has these different declinations, and place these dates, or so many of them as can be shown without confusion, opposite the corresponding marks on FDG. Draw the *sun-line* at the top of the card parallel to the line ACB; and, near the extremity, to the right, draw any small figure intended to form, as it were, a door of which *a b* shall be the hinge. Care must be taken that this hinge is exactly at right angles to the *sun-line*. ake a fine open slit *c d* right through the card and extending from the hinge to a short distance on the door,—the centre line of this slit coinciding accurately with the *sun-line*. Now, cut the door completely through the card; except, of course, along the hinge, which, when the card is thick, should be partly cut through at the back, to facilitate the opening. Cut the card right through along the line FDG, and pass a thread carrying a little plummet W and a *very* small bead P; the bead having sufficient friction with the thread to retain any position when acted on only by its own weight, but sliding easily along the thread when moved by the hand. At the back of the card the thread terminates in a knot to hinder it from being drawn through; or better, because giving more friction and a better hold, it passes through the centre of a small disk of card—a fraction of an inch in diameter—and, by a knot, is made fast at the back of the disk.

To complete the construction,—with the centres F and G, and

[1] Strict equality is not necessary, as the observations made are on the vertical line through each division-point, without reference to the others. It is not even requisite that the divisions should go completely and exactly round the cylinder, although they were always so drawn, and both these conditions were insisted upon in the directions for the construction.

radii FA and GA, draw the two arcs AY and AZ which will limit the hour-lines; for in an observation the bead will always be found between them. The forenoon and afternoon hours may then be marked as indicated in the figure. The dial does not of itself discriminate between forenoon and afternoon; but extraneous circumstances, as, for instance, whether the sun is rising or falling, will settle that point, except when close to noon, where it will always be uncertain.

To *rectify* the dial (using the old expression, which means to prepare the dial for an observation),—open the small door, by turning it about its hinge, till it stands well out in front. Next, set the thread in the line FG opposite the day of the month, and stretching it over the point A, slide the bead P along till it exactly coincide with A.

To find the hour of the day,—hold the dial in a vertical position in such a way that its plane may pass through the sun. The verticality is ensured by seeing that the bead rests against the card without pressing. Now gradually tilt the dial (without altering its vertical

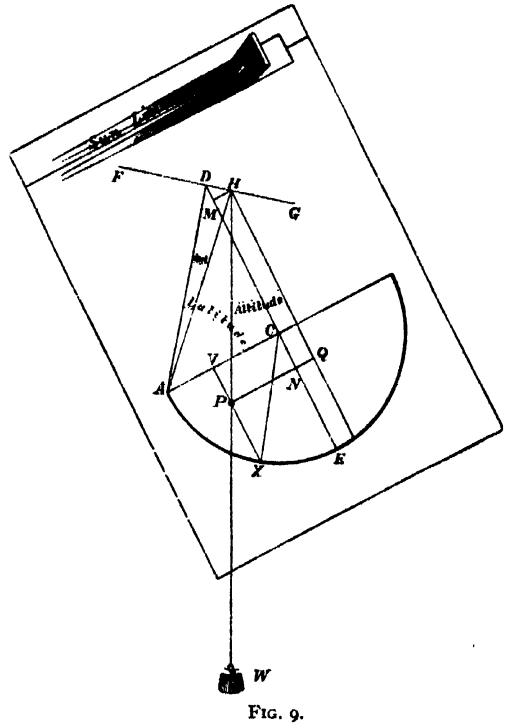


FIG. 9.

plane), until the central line of sunshine, passing through the open slit of the door, just falls along the sun-line. The hour-line against which the bead P then rests indicates the time.

The *sun-line* drawn above has always, so far as we know, been used as a *shadow-line*. The upper edge of the rectangular door was the prolongation of the line, and, the door being opened, the dial was gradually tilted until the shadow cast by the upper edge exactly coincided with it. But this shadow tilts the card one-quarter of a degree more than the sun-line, because it is given by that portion of the sun which just appears above the edge, that is, by the upper limb of the sun, which is one-quarter of a degree higher than the centre. Now, even at some distance from noon, the sun will sometimes take a considerable time to rise one-quarter of a degree, and by so much time will the indication of the dial be in error.

The central line of light which comes through the open slit will be free from this error, because it is given by light from the centre of the sun.

The card-dial deserves to be looked upon as something more than a mere toy. Its ingenuity and scientific accuracy give it an educational value which is not to be measured by the roughness of the results obtained.

The theory of this instrument is as follows:—Let H (fig. 9) be the point of suspension of the plummet at the time of observation, so that the angle DAH is the north declination of the sun,—P, the bead, resting against the hour-line VX. Join CX, then the angle ACX is the hour-angle from noon given by the bead, and we have to prove that this hour-angle is the correct one corresponding to a north latitude DAC, a north declination DAH and an altitude equal to the angle which the *sun-line*, or its parallel AC, makes with the horizontal. The angle PHQ will be equal to the altitude, if HQ be drawn parallel to DC, or the pair of lines HQ, HP will be respectively at right angles to the sun-line and the horizontal.

Draw PQ and HM parallel to AC, and let them meet DCE in M and N respectively.

Let HP and its equal HA be represented by a. Then the following values will be readily deduced from the figure:—

$AD = a \cos decl.$ $DH = a \sin decl.$ $PQ = a \sin alt.$

$CX = AC = AD \cos lat. = a \cos decl. \cos lat.$

$PN = CV = CX \cos ACX = a \cos decl. \cos lat. \cos ACX.$

$NQ = MH = DH \sin MDH = a \sin decl. \sin lat.$

(∴ the angle MDH = DAC = latitude.)

And since $PQ = NQ + PN$,

we have, by simple substitution,

$a \sin alt. = a \sin decl. \sin lat. + a \cos decl. \cos lat. \cos ACX$; or, dividing by a throughout,

$$\sin alt. = \sin decl. \sin lat. + \cos decl. \cos lat. \cos ACX \quad . \quad . \quad . \quad (1)$$

which equation determines the hour-angle ACX shown by the bead.

To determine the hour-angle of the sun at the same moment, let fig. 10 represent the celestial sphere, HR the horizon, P the pole, Z the zenith and S the sun.

From the spherical triangle PZS, we have

$\cos ZS = \cos PS \cos ZP + \sin PS \sin ZP \cos ZPS$

but ZS = zenith distance = 90° − altitude

ZP = 90° − PR = 90° − latitude

PS = polar distance = 90° − declination,

therefore, by substitution

$$\sin alt. = \sin decl. \sin lat. + \cos decl. \cos lat. \cos ZPS \quad . \quad . \quad . \quad (2)$$

and ZPS is the hour-angle of the sun.

A comparison of the two formulae (1) and (2) shows that the hour-angle given by the bead will be the same as that given by the sun, and proves the theoretical accuracy of the card-dial. Just at sun-rise or at sun-set the amount of refraction slightly exceeds half a degree. If, then, a little cross m (see fig. 8) be made just below the sun-line, at a distance from it which would subtend half a degree at c, the time of sun-set would be found corrected for refraction, if the central line of light were made to fall on cm.

LITERATURE.—The following list includes the principal writers on dialling whose works have come down to us, and to these we must refer for descriptions of the various constructions, some simple and direct, others fanciful and intricate, which have been at different times employed: Ptolemy, *Analemma*, restored by Commandine; Vitruvius, *Architecture*; Sebastian Münster, *Horologiographia*; Orontius Fineus, *De horologiis solaribus*; Mutio Oddi da Urbino, *Horologi solari*; Dryander, *De horologiorum compositione*; Conrad Gesner, *Pandectae*; Andreas Schöner, *Gnomonicae*; F. Commandine, *Horologiorum descriptio*; Joan. Bapt. Benedictus, *De gnomonum usu*; Georgius Schomberg, *Exegesis fundamentorum gnomonicorum*; Joan. Solomon de Caus, *Horologes solaires*; Joan. Bapt. Trolta, *Praxis horologiorum*; Desargues, *Manière universelle pour poser l'essieu*, &c.; Ath. Kircher, *Ars magna lucis et Umbrae*; Hallum, *Explicatio horologii in horto regio Londini*; Joan. Mark, *Tractatus horologiorum*; Clavius, *Gnomonices de horologiis*. Also among more modern writers, Deschales, Ozanam, Schottus, Wolfius, Picard, Lahire, Walper; in German, Paterson, Michael, Müller; in English, Foster, Wells, Collins, Leadbetter, Jones, Leybourn, Emerson and Ferguson. See also Hans Löschner, *Über Sonnenuhren* (2nd ed., Graz, 1906). (H. G.)

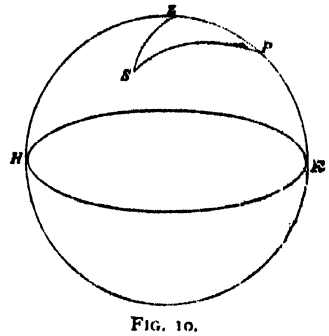


FIG. 10.

DIALECT (from Gr. διάλεκτος, conversation, manner of speaking, διαλέγεσθαι, to converse), a particular or characteristic manner of speech, and hence any variety of a language. In its widest sense languages which are branches of a common or parent language may be said to be "dialects" of that language; thus Attic, Ionic, Aeolic and Doric are dialects of Greek, though there may never have at any time been a separate language of which they were variations; so the various Romance languages, Italian, French, Spanish, &c., were dialects of Latin. Again, where there have existed side by side, as in England, various branches of a language, such as the languages of the Angles, the Jutes or the Saxons, and the descendant of one particular language, from many causes, has obtained the predominance, the traces of the other languages remain in the "dialects" of the districts where once the original language prevailed. Thus it may be incorrect, from the historical point of view, to say that "dialect" varieties of a language represent degradations of the standard language. A "literary" accepted language, such as modern English, represents the original language spoken in the Midlands, with accretions

of Norman, French, and later literary and scientific additions from classical and other sources, while the present-day "dialects" preserve, in inflections, pronunciation and particular words, traces of the original variety of the language not incorporated in the standard language of the country. See the various articles on languages (English, French, &c.).

DIALECTIC, or DIALECTICS (from Gr. διάλεκτος, discourse, debate; ἡ διαλεκτική, *sc.* τέχνη, the art of debate), a logical term, generally used in common parlance in a contemptuous sense for verbal or purely abstract disputation devoid of practical value. According to Aristotle, Zeno of Elea "invented" dialectic, the art of disputation by question and answer, while Plato developed it metaphysically in connexion with his doctrine of "Ideas" as the art of analysing ideas in themselves and in relation to the ultimate idea of the Good (*Repub.* vii.). The special function of the so-called "Socratic dialectic" was to show the inadequacy of popular beliefs. Aristotle himself used "dialectic," as opposed to "science," for that department of mental activity which examines the presuppositions lying at the back of all the particular sciences. Each particular science has its own subject matter and special principles (ἴδιαι ἀρχαί) on which the superstructure of its special discoveries is based. The Aristotelian dialectic, however, deals with the universal laws (κοιναὶ ἀρχαί) of reasoning, which can be applied to the particular arguments of all the sciences. The sciences, for example, all seek to define their own species; dialectic, on the other hand, sets forth the conditions which all definitions must satisfy whatever their subject matter. Again, the sciences all seek to educe general laws; dialectic investigates the nature of such laws, and the kind and degree of necessity to which they can attain. To this general subject matter Aristotle gives the name "Topics" (τόποι, *loci*, *communes loci*). "Dialectic" in this sense is the equivalent of "logic." Aristotle also uses the term for the science of probable reasoning as opposed to demonstrative reasoning (ἀποδεικτική). The Stoics divided λογική (logic) into rhetoric and dialectic, and from their time till the end of the middle ages dialectic was either synonymous with, or a part of, logic.

In modern philosophy the word has received certain special meanings. In Kantian terminology *Dialektik* is the name of that portion of the *Kritik d. reinen Vernunft* in which Kant discusses the impossibility of applying to "things-in-themselves" the principles which are found to govern phenomena. In the system of Hegel the word resumes its original Socratic sense, as the name of that intellectual process whereby the inadequacy of popular conceptions is exposed. Throughout its history, therefore, "dialectic" has been connected with that which is remote from, or alien to, unsystematic thought, with the a priori, or transcendental, rather than with the facts of common experience and material things.

DIALLAGE, an important mineral of the pyroxene group, distinguished by its thin foliated structure and bronzy lustre. The chemical composition is the same as diopside, $CaMg(SiO_3)_2$, but it sometimes contains the molecules $(Mg, Fe'')(Al, Fe''')_2SiO_6$ and $NaFe'''(SiO_3)_2$ in addition, when it approaches to augite in composition. Diallage is in fact an altered form of these varieties of pyroxene; the particular kind of alteration which they have undergone being known as "schillerization." This, as described by Prof. J. W. Judd, consists in the development of a fine lamellar structure or parting due to secondary twinning and the separation of secondary products along these and other planes of chemical weakness ("solution planes") in the crystal. The secondary products consist of mixtures of various hydrated oxides—opal, göthite, limonite, &c.—and appear as microscopic inclusions filling or partly filling cavities, which have definite outlines with respect to the enclosing crystal and are known as negative crystals. It is to the reflection and interference of light from these minute inclusions that the peculiar bronzy sheen or "schiller" of the mineral is due. The most pronounced lamination is that parallel to the orthopinacoid; another, less distinct, is parallel to the basal plane, and a third parallel to the plane of symmetry; these planes of secondary parting are in addition to the ordinary prismatic cleavage of all pyroxenes. Frequently the material is interlaminated with a rhombic pyroxene (bronzite) or with an amphibole (smaragdite or uralite), the latter being an alteration product of the diallage.

Diallage is usually greyish-green or dark green, sometimes brown, in colour, and has a pearly to metallic lustre or schiller on the laminated surfaces. The hardness is 4, and the specific gravity 3·2 to 3·35. It does not occur in distinct crystals with definite outlines, but only as lamellar masses in deep-seated igneous rocks, principally gabbro, of which it is an essential constituent. It occurs also in some peridotites and serpentines, and rarely in volcanic rocks (basalt) and crystalline schists. Masses of considerable size are found in the coarse-grained gabbros of the Island of Skye, Le Prese near Bornio in Valtellina, Lombardy, Prato near Florence, and many other localities.

The name diallage, from διαλλαγή, "difference," in allusion to the dissimilar cleavages and planes of fracture, as originally applied by R. J. Haüy in 1801, included other minerals (the orthorhombic pyroxenes hypersthene, bronzite and bastite, and the smaragdite variety of hornblende) which exhibit the same peculiarities of schiller structure; it is now limited to the monoclinic pyroxenes with this structure. Like the minerals of similar appearance just mentioned, it is sometimes cut and polished for ornamental purposes. (L. J. S.)

DIALOGUE, properly the conversation between two or more persons, reported in writing, a form of literature invented by the Greeks for purposes of rhetorical entertainment and instruction, and scarcely modified since the days of its invention. A dialogue is in reality a little drama without a theatre, and with scarcely any change of scene. It should be illuminated with those qualities which La Fontaine applauded in the dialogue of Plato, namely vivacity, fidelity of tone, and accuracy in the opposition of opinions. It has always been a favourite with those writers who have something to censure or to impart, but who love to stand outside the pulpit, and to encourage others to pursue a train of thought which the author does not seem to do more than indicate. The dialogue is so spontaneous a mode of expressing and noting down the undulations of human thought that it almost escapes analysis. All that is recorded, in any literature, of what pretend to be the actual words spoken by living or imaginary people is of the nature of dialogue. One branch of letters, the drama, is entirely founded upon it. But in its technical sense the word is used to describe what the Greek philosophers invented, and what the noblest of them lifted to the extreme refinement of an art.

The systematic use of dialogue as an independent literary form is commonly supposed to have been introduced by Plato, whose earliest experiment in it is believed to survive in the *Laches*. The Platonic dialogue, however, was founded on the mime, which had been cultivated half a century earlier by the Sicilian poets, Sophron and Epicharmus. The works of these writers, which Plato admired and imitated, are lost, but it is believed that they were little plays, usually with only two performers. The recently discovered mimes of Herodas (Herondas) give us some idea of their scope. Plato further simplified the form, and reduced it to pure argumentative conversation, while leaving intact the amusing element of character-drawing. He must have begun this about the year 405, and by 399 he had brought the dialogue to its highest perfection, especially in the cycle directly inspired by the death of Socrates. All his philosophical writings, except the *Apology*, are cast in this form. As the greatest of all masters of Greek prose style, Plato lifted his favourite instrument, the dialogue, to its highest splendour, and to this day he remains by far its most distinguished proficient. In the 2nd century A.D. Lucian of Samosata achieved a brilliant success with his ironic dialogues "Of the Gods," "Of the Dead," "Of Love" and "Of the Courtesans." In some of them he attacks superstition and philosophical error with the sharpness of his wit; in others he merely paints scenes of modern life. The title of Lucian's most famous collection was borrowed in the 17th century by two French writers of eminence, each of whom prepared *Dialogues des morts*. These were Fontenelle (1683) and Fénelon (1712). In English non-dramatic literature the dialogue had not been extensively

employed until Berkeley used it, in 1713, for his Platonic treatise, *Hylas and Philonous*. Landor's *Imaginary Conversations* (1821–1828) is the most famous example of it in the 19th century, although the dialogues of Sir Arthur Helps claim attention. In Germany, Wieland adopted this form for several important satirical works published between 1780 and 1799. In Spanish literature, the Dialogues of Valdés (1528) and those on Painting (1633) by Vincenzo Carducci, are celebrated. In Italian, collections of dialogues, on the model of Plato, have been composed by Torquato Tasso (1586), by Galileo (1632), by Galiani (1770), by Leopardi (1825), and by a host of lesser writers. In our own day, the French have returned to the original application of dialogue, and the inventions of "Gyp," of Henri Lavedan and of others, in which a mundane anecdote is wittily and maliciously told in conversation, would probably present a close analogy to the lost mimes of the early Sicilian poets, if we could meet with them. This kind of dialogue has been employed in English, and with conspicuous cleverness by Mr Anstey Guthrie, but it does not seem so easily appreciated by English as by French readers. (E. G.)

DIALYSIS (from the Gr. διά, through, λύειν, to loosen), in chemistry, a process invented by Thomas Graham for separating colloidal and crystalline substances. He found that solutions could be divided into two classes according to their action upon a porous diaphragm such as parchment. If a solution, say of salt, be placed in a drum provided with a parchment bottom, termed a "dialyser," and the drum and its contents placed in a larger vessel of water, the salt will pass through the membrane. If the salt solution be replaced by one of glue, gelatin or gum, it will be found that the membrane is impermeable to these solutes. To the first class Graham gave the name "crystalloids," and to the second "colloids." This method is particularly effective in the preparation of silicic acid. By adding hydrochloric acid to a dilute solution of an alkaline silicate, no precipitate will fall and the solution will contain hydrochloric acid, an alkaline chloride, and silicic acid. If the solution be transferred to a dialyser, the hydrochloric acid and alkaline chloride will pass through the parchment, while the silicic acid will be retained.

DIAMAGNETISM. Substances which, like iron, are attracted by the pole of an ordinary magnet are commonly spoken of as magnetic, all others being regarded as non-magnetic. It was noticed by A. C. Becquerel in 1827 that a number of so-called non-magnetic bodies, such as wood and gum lac, were influenced by a very powerful magnet, and he appears to have formed the opinion that the influence was of the same nature as that exerted upon iron, though much feebler, and that all matter was more or less magnetic. Faraday showed in 1845 (*Experimental Researches*, vol. iii.) that while practically all natural substances are indeed acted upon by a sufficiently strong magnetic pole, it is only a comparatively small number that are attracted like iron, the great majority being repelled. Bodies of the latter class were termed by Faraday *diamagnetics*. The strongest diamagnetic substance known is bismuth, its susceptibility being −0·000014, and its permeability 0·9998. The diamagnetic quality of this metal can be detected by means of a good permanent magnet, and its repulsion by a magnetic pole had been more than once recognized before the date of Faraday's experiments. The metals gold, silver, copper, lead, zinc, antimony and mercury are all diamagnetic; tin, aluminium and platinum are attracted by a very strong pole. (See MAGNETISM.)

DIAMANTE, FRA, Italian fresco painter, was born at Prato about 1400. He was a Carmelite friar, a member of the Florentine community of that order, and was the friend and assistant of Filippo Lippi. The Carmelite convent of Prato which he adorned with many works in fresco has been suppressed, and the buildings have been altered to a degree involving the destruction of the paintings. He was the principal assistant of Fra Filippo in the grand frescoes which may still be seen at the east end of the cathedral of Prato. In the midst of the work he was recalled to Florence by his conventual superior, and a minute of proceedings of the commune of Prato is still extant, in which it is determined to petition the metropolitan of Florence to obtain his return to Prato,—a proof that his share in the work was so important that his recall involved the suspension of it. Subsequently he assisted Fra Filippo in the execution of the frescoes still to be seen in the cathedral of Spoleto, which Fra Diamante completed in 1470 after his master's death in 1469. Fra Filippo left a son ten years old to the care of Diamante, who, having received 200 ducats from the commune of Spoleto, as the balance due for the work done in the cathedral, returned with the child to Florence, and, as Vasari says, bought land for himself with the money, giving but a small portion to the child. The accusation of wrong-doing, however, would depend upon the share of the work executed by Fra Diamante, and the terms of his agreement with Fra Filippo. Fra Diamante must have been nearly seventy when he completed the frescoes at Spoleto, but the exact year of his death is not known.

DIAMANTE, JUAN BAUTISTA (1640?–1684?), Spanish dramatist, was born at Castillo about 1640, entered the army, and began writing for the stage in 1657. He became a knight of Santiago in 1660; the date of his death is unknown, but no reference to him as a living author occurs after 1684. Like many other Spanish dramatists of his time, Diamante is deficient in originality, and his style is riddled with affectations; *La Desgraciada Raquel*, which was long considered to be his best play, is really Mira de Amescua's *Judía de Toledo* under another title; and the earliest of Diamante's surviving pieces, *El Honrador de su padre* (1658), is little more than a free translation of Corneille's *Cid*. Diamante is historically interesting as the introducer of French dramatic methods into Spain.

DIAMANTINA (formerly called *Tejuco*), a mining town of the state of Minas Geraes, Brazil, in the N.E. part of the state, 3710 ft. above sea-level. Pop. (1890) 17,980. Diamantina is built partly on a steep hillside overlooking a small tributary of the Rio Jequitinhonha (where diamond-washing was once carried on), and partly on the level plain above. The town is roughly but substantially built, with broad streets and large squares. It is the seat of a bishopric, with an episcopal seminary, and has many churches. Its public buildings are inconspicuous; they include a theatre, military barracks, hospitals, a lunatic asylum and a secondary school. There are several small manufactures, including cotton-weaving, and diamond-cutting is carried on. The surrounding region, lying on the eastern slopes of one of the lateral ranges of the Serra do Espinhaço, is rough and barren, but rich in minerals, principally gold and diamonds. Diamantina is the commercial centre of an extensive region, and has long been noted for its wealth. The date of the discovery of diamonds, upon which its wealth and importance chiefly depend, is uncertain, but the official announcement was made in 1729, and in the following year the mines were declared crown property, with a crown reservation, known as the "forbidden district," 42 leagues in circumference and 8 to 16 leagues in diameter. Gold-mining was forbidden within its limits and diamond-washing was placed under severe restrictions. There are no trustworthy returns of the value of the output, but in 1849 the total was estimated up to that date at 300,000,000 francs (see DIAMOND). The present name of the town was assumed (instead of Tejuco) in 1838, when it was made a *cidade*.

DIAMANTINO, a small town of the state of Matto Grosso, Brazil, near the Diamantino river, about 6 m. above its junction with the Paraguay, in 14° 24′ 33″ S., 56° 8′ 30″ W. Pop. (1890) of the municipality 2147, mostly Indians. It stands in a broken sterile region 1837 ft. above sea-level and at the foot of the great Matto Grosso plateau. The first mining settlement dates from 1730, when gold was found in the vicinity. On the discovery of diamonds in 1746 the settlement drew a large population and for a time was very prosperous. The mines failed to meet expectations, however, and the population has steadily declined. Ipecacuanha and vanilla beans are now the principal articles of export.

DIAMETER (from the Gr. διά, through, μέτρον, measure), in geometry, a line passing through the centre of a circle or conic section and terminated by the curve; the "principal diameters" of the ellipse and hyperbola coincide with the "axes" and are at

right angles; "conjugate diameters" are such that each bisects chords parallel to the other. The diameter of a quadric surface is a line at the extremities of which the tangent planes are parallel. Newton defined the diameter of a curve of any order as the locus of the centres of the mean distances of the points of intersection of a system of parallel chords with the curve; this locus may be shown to be a straight line. The word is also used as a unit of linear measurement of the magnifying power of a lens or microscope.

In architecture, the term is used to express the measure of the lower part of the shaft of a column. It is employed by Vitruvius (iii. 2) to determine the height of a column, which should vary from eight to ten diameters according to the intercolumniation: and it is generally the custom to fix the lower diameter of the shaft by the height required and the Order employed. Thus the diameter of the Roman Doric should be about one-eighth of the height, that of the Ionic one-ninth, and of the Corinthian one-tenth (see ORDER).

DIAMOND, a mineral universally recognized as chief among precious stones; it is the hardest, the most imperishable, and also the most brilliant of minerals.[1] These qualities alone have made it supreme as a jewel since early times, and yet the real brilliancy of the stone is not displayed until it has been faceted by the art of the lapidary (*q.v.*); and this was scarcely developed before the year 1746. The consummate hardness of the diamond, in spite of its high price, has made it most useful for purposes of grinding, polishing and drilling. Numerous attempts have been made to manufacture the diamond by artificial means, and these attempts have a high scientific interest on account of the mystery which surrounds the natural origin of this remarkable mineral. Its physical and chemical properties have been the subject of much study, and have a special interest in view of the extraordinary difference between the physical characters of the diamond and those of graphite (blacklead) or charcoal, with which it is chemically identical, and into which it can be converted by the action of heat or electricity. Again, on account of the great value of the diamond, much of the romance of precious stones has centred round this mineral; and the history of some of the great diamonds of historic times has been traced through many extraordinary vicissitudes.

The name Ἀδάμας, "the invincible," was probably applied by the Greeks to hard metals, and thence to corundum (emery) and other hard stones. According to Charles William King, the first undoubted application of the name to the diamond is found in Manilius (A.D. 16),—*Sic Adamas, punctum lapidis, pretiosior auro,*—and Pliny (A.D. 100) speaks of the rarity of the stone, "the most valuable of gems, known only to kings." Pliny described six varieties, among which the Indian, having six pointed angles, and also resembling two pyramids (*turbines*, whip-tops) placed base to base, may probably be identified as the ordinary octahedral crystal (fig. 1). The "diamond" (*Yahalom*) in the breastplate of the high priest (Ex. xxxix. 11) was certainly some other stone, for it bore the name of a tribe, and methods of engraving the true diamond cannot have been known so early. The stone can hardly have become familiar to the Romans until introduced from India, where it was probably mined at a very early period. But one or other of the remaining varieties mentioned by Pliny (the Macedonian, the Arabian, the Cyprian, &c.) may be the true diamond, which was in great request for the tool of the gem-engraver. Later Roman authors mentioned various rivers in India as yielding the *Adamas* among their sands. The name *Adamas* became corrupted into the forms *adamant, diamaunt, diamant, diamond*; but the same word, owing to a medieval misinterpretation which derived it from *adamare* (compare the French word *aimant*), was also applied to the lodestone.

Like all the precious stones, the diamond was credited with many marvellous virtues; among others the power of averting insanity, and of rendering poison harmless; and in the middle ages it was known as the "pietra della reconciliazione," as the peacemaker between husband and wife.

Scientific Characters.—The majority of minerals are found most commonly in masses which can with difficulty be recognized as aggregates of crystalline grains, and occur comparatively seldom as distinct crystals; but the diamond is almost always found in single crystals, which show no signs of previous attachment to any matrix; the stones were, until the discovery of the South African mines, almost entirely derived from sands or gravels, but owing to the hardness of the mineral it is rarely, if ever, water-worn, and the crystals are often very perfect. The crystals belong to the cubic system, generally assuming the form of the octahedron (fig. 1), but they may, in accordance with the principles of crystallography, also occur in other forms symmetrically derived from the octahedron,—for example, the cube, the 12-faced figure known as the rhombic dodecahedron (fig. 2), or the 48-faced figure known as the hexakis-octahedron (fig. 3), or in combinations of these. The octahedron faces are usually smooth; most of the other faces are rounded (fig. 4). The cube

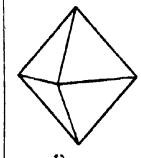


FIG. 1.

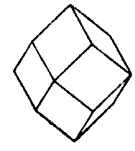


FIG. 2.

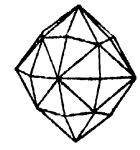


FIG. 3.

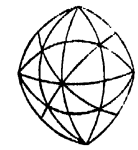


FIG. 4.

faces are rough with protruding points. The cube is sometimes found in Brazil, but is very rare among the S. African stones; and the dodecahedron is perhaps more common in Brazil than elsewhere. There is often a furrow running along the edges of the octahedron, or across the edges of the cube, and this indicates that the apparently simple crystal may really consist of eight individuals meeting at the centre; or, what comes to the same thing, of two individuals interpenetrating and projecting through each other. If this be so the form of the diamond is really the tetrahedron (and the various figures derived symmetrically from it) and not the octadehron. Fig. 5 shows how the octahedron with furrowed edge may be constructed from two interpenetrating tetrahedra (shown in dotted lines). If the grooves be left out of account, the large faces which have replaced each tetrahedron corner then make up a figure which has the aspect of a simple octahedron. Such regular interpenetrations are known in crystallography as "twins." There are also twins of diamond in which two octahedra (fig. 6) are united by contact along a surface parallel to an octahedron face without interpenetration. On account of their resemblance to the twins of the mineral spinel (which crystallizes in octadehra) these are known as "spinel twins." They are generally flattened along the plane of union. The crystals often display triangular markings, either elevations or pits, upon the octahedron faces; the latter are particularly well defined and have the form of equilateral triangles (fig. 7). They are similar to the "etched figures" produced by moistening an octahedron of alum, and have probably been produced, like them, by the action of some solvent. Similar, but somewhat different markings are produced by the combustion of diamond in oxygen, unaccompanied by any rounding of the edges.

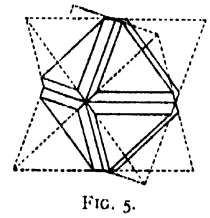


FIG. 5.

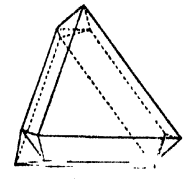


FIG. 6.

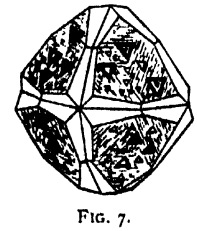


FIG. 7.

Diamond possesses a brilliant "adamantine" lustre, but this tends to be greasy on the surface of the natural stones and gives

[1] Diamonds are invariably weighed in carats and in $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$ of a carat. One (English) carat = 3·17 grains = ·2054 gram. One ounce = 151½ carats. (See CARAT.)

the rounded crystals somewhat the appearance of drops of gum. Absolutely colourless stones are not so common as cloudy and faintly coloured specimens; the usual tints are grey, brown, yellow or white; and as rarities, red, green, blue and black stones have been found. The colour can sometimes be removed or changed at a high temperature, but generally returns on cooling. It is therefore more probably due to metallic oxides than to hydrocarbons. Sir William Crookes has, however, changed a pale yellow diamond to a bluish-green colour by keeping it embedded in radium bromide for eleven weeks. The black coloration upon the surface produced by this process, as also by the electric bombardment in a vacuum tube, appears to be due to a conversion of the surface film into graphite. Diamond may break with a conchoidal fracture, but the crystals always cleave readily along planes parallel to the octahedron faces: of this property the diamond cutters avail themselves when reducing the stone to the most convenient form for cutting; a sawing process, has, however, now been introduced, which is preferable to that of cleavage. It is the hardest known substance (though tantalum, or an alloy of tantalum, now competes with it) and is chosen as 10 in the mineralogist's scale of hardness; but the difference in hardness between diamond (10) and corundum (9) is really greater than that between corundum (9) and talc (1); there is a difference in the hardness of the different faces; the Borneo stones are also said to be harder than those of Australia, and the Australian harder than the African, but this is by no means certain. The specific gravity ranges from 3·56 to 3·50, generally about 3·52. The coefficient of expansion increases very rapidly above 750°, and diminishes very rapidly at low temperatures; the maximum density is attained about −42° C.

The very high refractive power (index = 2·417 for sodium light) gives the stone its extraordinary brilliancy; for light incident within a diamond at a greater angle than 24½° is reflected back into the stone instead of passing through it; the corresponding angle for glass is 40½°. The very high dispersion (index for red light = 2·402, for blue light = 2·460) gives it the wonderful "fire" or display of spectral colours. Certain absorption bands at the blue end of the spectrum are supposed to be due to rare elements such as samarium. Unlike other cubic crystals, diamond experiences a diminution of refractive index with increase of temperature. It is very transparent for Röntgen rays, whereas paste imitations are opaque. It is a good conductor of heat, and therefore feels colder to the touch than glass and imitation stones. The diamond has also a somewhat greasy feel. The specific heat increases rapidly with rising temperature up to 60° C., and then more slowly. Crystals belonging to the cubic system should not be birefringent unless strained; diamond often displays double refraction particularly in the neighbourhood of inclusions, both liquid and solid; this is probably due to strain, and the spontaneous explosion of diamonds has often been observed. Diamond differs from graphite in being a bad conductor of electricity: it becomes positively electrified by friction. The electrical resistance is about that of ordinary glass, and is diminished by one-half during exposure to Röntgen rays; the dielectric constant (16) is greater than that which should correspond to the specific gravity.

The phosphorescence produced by friction has been known since the time of Robert Boyle (1663); the diamond becomes luminous in a dark room after exposure to sunlight or in the presence of radium; and many stones phosphoresce beautifully (generally with a pale green light) when subjected to the electric discharge in a vacuum tube. Some diamonds are more phosphorescent than others, and different faces of a crystal may display different tints. The combustibility of the diamond was predicted by Sir Isaac Newton on account of its high refractive power; it was first established experimentally by the Florentine Academicians in 1694. In oxygen or air diamond burns at about 850°, and only continues to do so if maintained at a high temperature; but in the absence of oxidizing agents it may be raised to a much higher temperature. It is, however, infusible at the temperature of the electric arc, but becomes converted superficially into graphite. Experiments on the combustion of diamond were made by Smithson Tennant (1797) and Sir Humphry Davy (1816), with the object of proving that it is pure carbon; they showed that burnt in oxygen it yields exactly the same amount of carbon dioxide as that produced by burning the same weight of carbon. Still more convincing experiments were made by A. Krause in 1890. Similarly Guyton de Morveau showed that, like charcoal, diamond converts soft iron into steel. Diamond is insoluble in acid and alkalis, but is oxidized on heating with potassium bichromate and sulphuric acid.

Bort (or Boart) is the name given to impure crystals or fragments useless for jewels; it is also applied to the rounded crystalline aggregates, which generally have a grey colour, a rough surface, often a radial structure, and are devoid of good cleavage. They are sometimes spherical ("shot bort"). Carbonado or "black diamond," found in Bahia (also recently in Minas Geraes), is a black material with a minutely crystalline structure somewhat porous, opaque, resembling charcoal in appearance, devoid of cleavage, rather harder than diamond, but of less specific gravity; it sometimes displays a rude cubic crystalline form. The largest specimen found (1895) weighed 3078 carats. Both bort and carbonado seem to be really aggregates of crystallized diamond, but the carbonado is so nearly structureless that it was till recently regarded as an amorphous modification of carbon.

Uses of the Diamond.—The use of the diamond for other purposes than jewelry depends upon its extreme hardness: it has always been the only material used for cutting or engraving the diamond itself. The employment of powdered bort and the lapidary's wheel for faceting diamonds was introduced by L. von Berquen of Bruges in 1476. Diamonds are now employed not only for faceting precious stones but also for cutting and drilling glass, porcelain, &c.; for fine engraving such as scales; in dentistry for drilling; as a turning tool for electric-light carbons, hard rubber, &c.; and occasionally for finishing accurate turning work such as the axle of a transit instrument. For these tools the stone is actually shaped to the best form: it is now electroplated before being set in its metal mount in order to secure a firm fastening. It is also used for bearings in watches and electric meters. The best glaziers' diamonds are chosen from crystals such that a natural curved edge can be used. For rock drills, and revolving saws for stone cutting, either diamond, bort or carbonado is employed, set in steel tubes, disks or bands. Rock drilling is the most important industrial application; and for this, owing to its freedom from cleavage, the carbonado is more highly prized than diamond; it is broken into fragments about 3 carats in weight; and in 1905 the value of carbonado was no less than from £10 to £14 a carat. It has been found that the "carbons" in drills can safely be subjected to a pressure of over 60 kilograms per square millimetre, and a speed of 25 metres per second. A recent application of the diamond is for wire drawing; a hole tapering towards the centre is drilled through a diamond, and the metal is drawn through this. No other tool is so endurable, or gives such uniform thickness of wire.

Distribution and Mining.—The most important localities for diamonds have been: (1) India, where they were mined from the earliest times till the close of the 19th century; (2) South America, where they have been mined since the middle of the 18th century; and (3) South Africa, to which almost the whole of the diamond-mining industry has been transferred since 1870.

India.—The diamond is here found in ancient sandstones and conglomerates, and in the river gravels and sands derived from them. The sandstones and conglomerates belong to the Vindhyan formation and overlie the old crystalline rocks: the diamantiferous beds are well defined, often not more than 1 ft. in thickness, and contain pebbles of quartzite, jasper, sandstone, slate, &c. The mines fall into five groups situated on the eastern side of the Deccan plateau about the following places (beginning from the south), the first three being in Madras. (1) Chennur near Cuddapah on the river Pennar. (2) Kurnool near Banganapalle between the rivers Pennar and Kistna. (3) Kollar near Bezwada on the river Kistna. (4) Sambalpur on the river Mahanadi in the Central Provinces. (5) Panna near Allahabad, in Bundelkhand. The mining has always been carried on by natives of low caste, and by primitive methods which do not differ much from those described by the French merchant Jean Baptiste Tavernier (1605–1689), who paid a prolonged visit to most

of the mines between 1638 and 1665 as a dealer in precious stones. According to his description shallow pits were sunk, and the gravel excavated was gathered into a walled enclosure where it was crushed and water was poured over it, and it was finally sifted in baskets and sorted by hand. The buying and selling was at that period conducted by young children. In more modern times there has been the same excavation of shallow pits, and sluicing, sifting and sorting, by hand labour, the only machinery used being chain pumps made of earthen bowls to remove the water from the deeper pits.

At some of the Indian localities spasmodic mining has been carried on at different periods for centuries, at some the work which had been long abandoned was revived in recent times, at others it has long been abandoned altogether. Many of the large stones of antiquity were probably found in the Kollar group, where Tavernier found 60,000 workers in 1645(?), the mines having, according to native accounts, been discovered about 100 years previously. Golconda was the fortress and the market for the diamond industry at this group of mines, and so gave its name to them. The old mines have now been completely abandoned, but in 1891 about 1000 carats were being raised annually in the neighbourhood of Hyderabad. The Sambalpur group appear to have been the most ancient mines of all, but they were not worked later than 1850. The Panna group were the most productive during the 19th century. India was no doubt the source of all the large stones of antiquity; a stone of 67⅜ carats was found at Wajra Karur in the Chennur group in 1881, and one of 210½ carats at Hira Khund in 1809. Other Indian localities besides those mentioned above are Simla, in the N.W. Provinces, where a few stones have been found, and a district on the Gouel and the Sunk rivers in Bengal, which V. Ball has identified with the Soumelpour mentioned by Tavernier. The mines of Golconda and Kurnool were described as early as 1677 in the twelfth volume of the *Philosophical Transactions* of the Royal Society. At the present time very few Indian diamonds find their way out of the country, and, so far as the world's supply is concerned, Indian mining of diamonds may be considered extinct. The first blow to this industry was the discovery of the Brazilian mines in Minas Geraes and Bahia.

Brazil.—Diamonds were found about 1725 at Tejuco (now Diamantina) in Minas Geraes, and the mining became important about 1740. The chief districts in Minas Geraes are (1) Bagagem on the W. side of the Serra da Mata da Corda; (2) Rio Abaete on the E. side of the same range; these two districts being among the head waters of the Rio de San Francisco and its tributaries; (3) Diamantina, on and about the watershed separating the Rio de San Francisco from the Rio Jequitinhonha; and (4) Grao Mogul, nearly 200 m. to the N.E. of Diamantina on the latter river.

The Rio Abaete district was worked on a considerable scale between 1785 and 1807, but is now abandoned. Diamantina is at present the most important district; it occupies a mountainous plateau, and the diamonds are found both on the plateau and in the river valleys below it. The mountains consist here of an ancient laminated micaceous quartzite, which is in parts a flexible sandstone known as itacolumite, and in parts a conglomerate; it is interbedded with clay-slate, mica-schist, hornblende-schist and haematite-schist, and intersected by veins of quartz. This series is overlain unconformably by a younger quartzite of similar character, and itself rests upon the crystalline schists. The diamond is found under three conditions: (1) in the gravels of the present rivers, embedded in a ferruginous clay-cemented conglomerate known as *cascalho*; (2) in terraces (gupiarras) in a similar conglomerate occupying higher levels in the present valleys; (3) in plateau deposits in a coarse surface conglomerate known as *gurgulho*, the diamond and other heavy minerals being embedded in the red clay which cements the larger blocks. Under all these three conditions the diamond is associated with fragments of the rocks of the country and the minerals derived from them, especially quartz, hornstone, jasper, the polymorphous oxide of titanium (rutile, anatase and brookite), oxides and hydrates of iron (magnetite, ilmenite, haematite, limonite), oxide of tin, iron pyrites, tourmaline, garnet, xenotime, monazite, kyanite, diaspore, sphene, topaz, and several phosphates, and also gold. Since the heavy minerals of the *cascalho* in the river beds are more worn than those of the terraces, it is highly probable that they have been derived by the cutting down of the older river gravels represented by the terraces; and since in both deposits the heavy minerals are more abundant near the heads of the valleys in the plateau, it is also highly probable that both have really been derived from the plateau deposit. In the latter, especially at São João da Chapada, the minerals accompanying the diamond are scarcely worn at all; in the terraces and the river beds they are more worn and more abundant; the terraces, therefore, are to be regarded as a first concentration of the plateau material by the old rivers; and the *cascalho* as a second concentration by the modern rivers. The mining is carried on by negroes under the supervision of overseers; the *cascalho* is dug out in the dry season and removed to a higher level, and is afterwards washed out by hand in running water in shallow wooden basins (*bateas*). The terraces can be worked at all seasons, and the material is partly washed out by leading streams on to it. The washing of the plateau material is effected in reservoirs of rain water.

It is difficult to obtain an estimate of the actual production of the Minas Geraes mines, for no official returns have been published, but in recent years it has certainly been rivalled by the yield in Bahia. The diamond here occurs in river gravels and sands associated with the same minerals as in Minas Geraes; since 1844 the richest mines have been worked in the Serra de Cincora, where the mountains are intersected by the river Paraguassu and its tributaries; it is said that there were as many as 20,000 miners working here in 1845, and it was estimated that 54,000 carats were produced in Bahia in 1858. The earlier workings were in the Serra de Chapada to the N.W. of the mines just mentioned. In 1901 there were about 5000 negroes employed in the Bahia mines; methods were still primitive; the *cascalho* was dug out from the river beds or tunnelled out from the valley side, and washed once a week in sluices of running water, where it was turned over with the hoe, and finally washed in wooden basins and picked over by hand; sometimes also the diamantiferous material is scooped out of the bed of the shallow rivers by divers, and by men working under water in caissons. It is almost exclusively in the mines of Bahia, and in particular in the Cincora district, that the valuable carbonado is found. The carbonado and the diamond have been traced to an extensive hard conglomerate which occurs in the middle of the sandstone formation. Diamonds are also mined at Salobro on the river Pardo not far inland from the port of Canavieras in the S.E. corner of Bahia. The enormous development of the South African mines, which supplied in 1906 about 90 % of the world's produce, has thrown into the shade the Brazilian production; but the *Bulletin* for Feb. 1909 of the International Bureau of American Republics gave a very confident account of its future, under improved methods.

South Africa.—The first discovery was made in 1867 by Dr W. G. Atherstone, who identified as diamond a pebble obtained from a child in a farm on the banks of the Orange river and brought by a trader to Grahamstown; it was bought for £500 and displayed in the Paris Exhibition of that year. In 1869 a stone weighing 83½ carats was found near the Orange river; this was purchased by the earl of Dudley for £25,000 and became famous as the "Star of South Africa." A rush of prospectors at once took place to the banks of the Orange and Vaal rivers, and resulted in considerable discoveries, so that in 1870 there was a mining camp of no less than 10,000 persons on the "River Diggings." In the River Diggings the mining was carried on in the coarse river gravels, and by the methods of the Brazilian negroes and of gold placer-miners. A diggers' committee limited the size of claims to 30 ft. square, with free access to the river bank; the gravel and sand were washed in cradles provided with screens of perforated metal, and the concentrates were sorted by hand on tables by means of an iron scraper.

But towards the close of 1870 stones were found at Jagersfontein and at Dutoitspan, far from the Vaal river, and led to a second great rush of prospectors, especially to Dutoitspan, and in 1871 to what is now the Kimberley mine in the neighbourhood of the latter. At each of these spots the diamantiferous area was a roughly circular patch of considerable size, and in some occupied the position of one of those depressions or "pans" so frequent in S. Africa. These "dry diggings" were therefore at first supposed to be alluvial in origin like the river gravels; but it was soon discovered that, below the red surface soil and the underlying calcareous deposit, diamonds were also found in a layer of yellowish clay about 50 ft. thick known as "yellow ground." Below this again was a hard bluish-green serpentinous rock which was at first supposed to be barren bed-rock; but this also contained the precious stone, and has become famous, under the name of "blue ground," as the matrix of the S. African diamonds. The yellow ground is merely decomposed blue ground. In the Kimberley district five of these round patches of blue ground were found within an area little more than 3 m. in diameter; that at Kimberley occupying 10 acres, that at Dutoitspan 23 acres. There were soon 50,000 workers on this field, the canvas camp was replaced by a town of brick and iron surrounded by the wooden huts of the natives, and Kimberley became an important centre.

It was soon found that each mine was in reality a huge vertical funnel or crater descending to an unknown depth, and filled with diamantiferous blue ground. At first each claim was an independent pit 31 ft. square sunk into the blue ground; the diamantiferous rock was hoisted by bucket and windlass, and roadways were left across the pit to provide access to the claims. But the roadways soon fell in, and ultimately haulage from the claims could only be provided by means of a vast system of wire ropes extending from a triple staging of windlasses erected round the entire edge of the mine, which had by this time become a huge open pit; the ropes from the upper windlasses extended to the centre, and those from the lower tier to the sides of the pit; covering the whole mass like a gigantic cobweb. (See Plate II. fig. 12.) The buckets of blue ground were hauled up these ropes by means of horse whims, and in 1875 steam winding engines began to be employed. By this time also improved methods in the treatment of the blue ground were introduced. It was carried off in carts to open spaces, where an exposure of some weeks to the air was found to pulverize the hard rock far more efficiently than the old method of crushing with mallets. The placer-miner's cradle and rocking-trough were replaced by puddling troughs stirred by a revolving comb worked by horse power; reservoirs were constructed for the scanty water-supply, bucket elevators were introduced to carry away the tailings; and the natives were confined in compounds. For these improvements co-operation was necessary; the better claims, which in 1872 had risen from £100 to more than £4000 in value, began to be consolidated, and a Mining Board was introduced.

FIG. 9.—DE BEERS MINE, 1874.

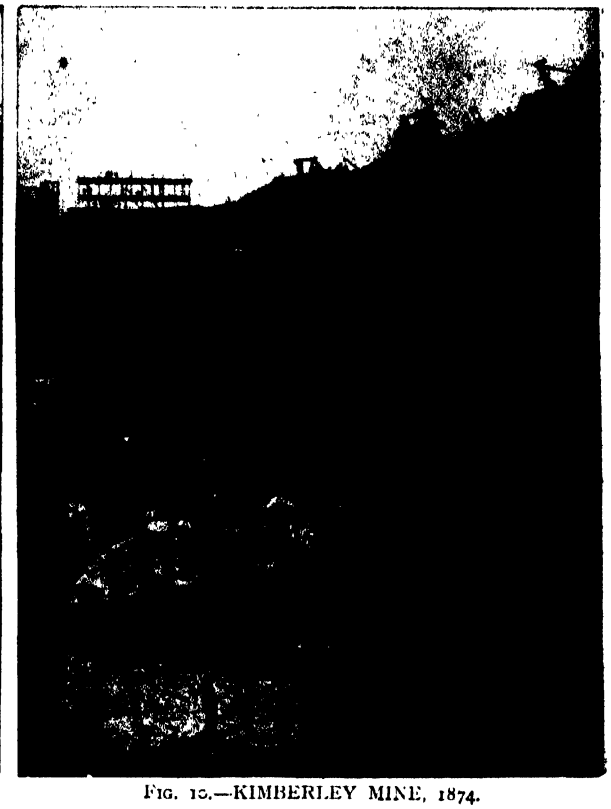


FIG. 10.—KIMBERLEY MINE, 1874.

FIG. 11.—DE BEERS MINE, 1873.

(From photographs by C. Evan

FIG. 12. KIMBERLEY MINE 1874.

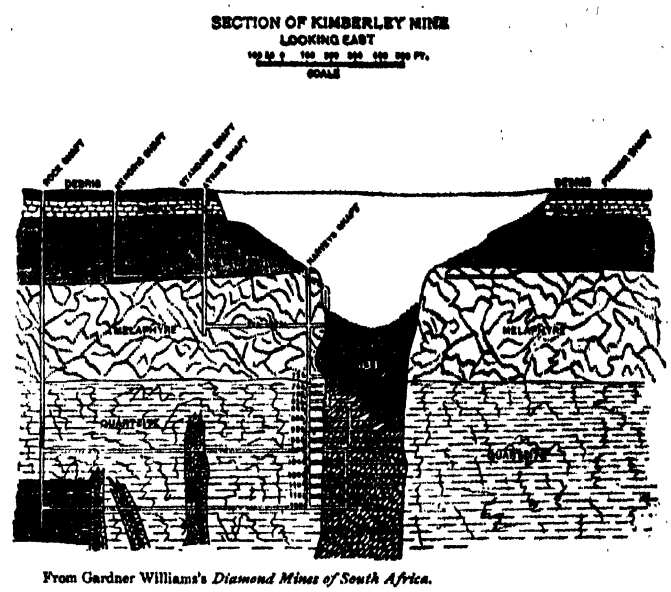
FIG. 13.—KIMBERLEY MINE, 1902.

(From photographs by C. Evans.)

In a very few years, however, the open pit mining was rendered impossible by the mud rushes, by the falls of the masses of barren rock known as "reef," which were left standing in the mine, and by landslips from the sides, so that in 1883, when the pit had reached a depth of about 400 ft., mining in the Kimberley crater had become almost impossible. By 1889, in the whole group of mines, Kimberley, Dutoitspan, De Beers and Bultfontein, open pit working was practically abandoned. Meanwhile mining below the bottom of the pits by means of shafts and underground tunnels had been commenced; but the full development of modern methods dates from the year 1889 when Cecil Rhodes and Alfred Beit, who had already secured control of the De Beers mine, acquired also the control of the Kimberley mine, and shortly afterwards consolidated the entire group in the hands of the De Beers Company. (See KIMBERLEY.)

The scene of native mining was now transferred from the open pit to underground tunnels; the vast network of wire ropes (Plate II. fig. 12) with their ascending and descending buckets disappeared, and with it the cosmopolitan crowd of busy miners working like ants at the bottom of the pit. In place of all this, the visitor to Kimberley encounters at the edge of the town only a huge crater, silent and apparently deserted, with no visible sign of the great mining operations which are conducted nearly half a mile below the surface. The aspect of the Kimberley pit in 1906 is shown in fig. 13 of Plate II., which may be compared with the section of fig. 8.

In fig. 13, Plate II., the sequence of the basalt, shale and melaphyre is clearly visible on the sides of the pit; and fig. 8 shows how the crater of "pipe" of blue ground has penetrated these rocks and also the underlying quartzite. The workings at De Beers had extended into the still more deeply seated granite in 1906. Figure 9, Plate I., shows the top of the De Beers' crater with basalt overlying the shale. Figure 8 also explains the modern system of mining introduced by Gardner Williams. A vertical shaft is sunk in the vicinity of the mine, and from this horizontal tunnels are driven into the pipe at different levels separated by intervals of 40 ft. Through the blue ground itself on each level a series of parallel tunnels about 120 ft. apart are driven to the opposite side of the pipe, and at right angles to these, and 36 ft. apart, another series of tunnels. When the tunnels reach the side of the mine they are opened upwards and sideways so as to form a large chamber, and the overlying mass of blue ground and débris is allowed to settle down and fill up the gallery. On each level this process is carried somewhat farther back than on the level below (fig. 8); material is thus continually withdrawn from one side of the mine and extracted by means of the rock shaft on the opposite side, while the superincumbent débris is continually sinking, and is allowed to fall deeper on the side farthest from the shaft as the blue ground is withdrawn from beneath it. In 1905 the main shaft had been sunk to a depth of 2600 ft. at the Kimberley mine.



From Gardner Williams's *Diamond Mines of South Africa.*

FIG. 8.

For the extraction and treatment of the blue ground the De Beers Company in its great winding and washing plant employs labour-saving machinery on a gigantic scale. The ground is transferred in trucks to the shaft where it is automatically tipped into skips holding 96 cubic ft. (six truck loads); these are rapidly hoisted to the surface, where their contents are automatically dumped into side-tipping trucks, and these in turn are drawn away in a continual procession by an endless wire rope along the tram lines leading to the vast "distributing floors." These are open tracts upon which the blue ground is spread out and left exposed to sun and rain until it crumbles and disintegrates, the process being hastened by harrowing with steam ploughs; this may require a period of three or six months, or even a year. The stock of blue ground on the floors at one time in 1905 was nearly 4,500,000 loads. The disintegrated ground is then brought back in the trucks and fed through perforated cylinders into the washing pans; the hard blue which has resisted disintegration on the floors, and the lumps which are too big to pass the cylindrical sieves, are crushed before going to the pans. These are shallow cylindrical troughs containing muddy water in which the diamonds and other heavy minerals (concentrates) are swept to the rim by revolving toothed arms, while the lighter stuff escapes near the centre of the pan. The concentrates are then passed over sloping tables (pulsator) and shaken to and fro under a stream of water which effects a second concentration of the heaviest material.

Until recently the final separation of the diamond from the concentrates was made by hand picking, but even this has now been replaced by machinery, owing to the remarkable discovery that a greased surface will hold a diamond while allowing the other heavy minerals to pass over it. The concentrates are washed down a sloping table of corrugated iron which is smeared with grease, and it is found that practically all the diamonds adhere to the table, and the other minerals are washed away. At the large and important Premier mine in the Transvaal the Elmore process, used in British Columbia and in Wales for the separation of metallic ores, has been also introduced. In the Elmore process oil is employed to float off the materials which adhere to it, while the other materials remain in the water, the oil being separated from the water by centrifugal action. The other minerals found in the concentrates are pebbles and fragments of pyrope, zircon, cyanite, chrome-diopside, enstatite, a green pyroxene, mica, ilmenite, magnetite, chromite, hornblende, olivine, barytes, calcite and pyrites.

In all the S. African mines the diamonds are not only crystals of various weights from fractions of a carat to 150 carats, but also occur as microscopic crystals disseminated through the blue ground. In spite of this, however, the average yield in the profitable mines is only from 0·2 carat to 0·6 carat per load of 1600 lb, or on an average about 1½ grs. per ton. The annual output of diamonds from the De Beers mines was valued in 1906 at nearly £5,000,000; the value per carat ranging from about 35s. to 70s.

Pipes similar to those which surround Kimberley have been found in other parts of S. Africa. One of the best known is that of Jagersfontein, which was really the first of the dry diggings (discovered in 1870). This large mine is near Fauresmith and 80 m. to the south of Kimberley. In 1905 the year's production from the Orange River Colony mines was more than 320,000 carats, valued at £938,000. But by far the largest of all the pipes hitherto discovered is the Premier mine in the Transvaal, about 300 m. to the east of Kimberley. This was discovered in 1902 and occupies an area of about 75 acres. In 1906 it was being worked as a shallow open mine; but the description of the Kimberley methods given above is applicable to the washing plant at that time being introduced into the Premier mine upon a very large scale. Comparatively few of the pipes which have been discovered are at all rich in diamonds, and many are quite barren; some are filled with "hard blue" which even if diamantiferous may be too expensive to work.

The most competent S. African geologists believe all these remarkable pipes to be connected with volcanic outbursts which occurred over the whole of S. Africa during the Cretaceous period (after the deposition of the Stormberg beds), and drilled these enormous craters through all the later formations. With the true pipes are associated dykes and fissures also filled with diamantiferous blue ground. It is only in the more northerly part of the country that the pipes are filled with blue ground (or "kimberlite"), and that they are diamantiferous; but over a great part of Cape Colony have been discovered what are probably similar pipes filled with agglomerates, breccias and tuffs, and some with basic lavas; one, in particular, in the Riversdale Division near the southern coast, being occupied by a melilite-basalt. It is quite clear that the occurrence of the diamond in the S. African pipes is quite different from the occurrences in alluvial deposits which have been described above. The question of the origin of the diamond in S. Africa and elsewhere is discussed below.

The River Diggings on the Vaal river are still worked upon a small scale, but the production from this source is so limited that they are of little account in comparison with the mines in the blue ground. The stones, however, are good; since they differ somewhat from the Kimberley crystals it is probable that they were not derived from the present pipes. Another S. African locality must be mentioned; considerable finds were reported in 1905 and 1906 from gravels at Somabula near Gwelo in Rhodesia where the diamond is associated with chrysoberyl, corundum (both sapphire and ruby), topaz, garnet, ilmenite, staurolite, rutile, with pebbles of quartz, granite,

chlorite-schist, &c. Diamond has also been reported from kimberlite "pipes" in Rhodesia.

Other Localities.—In addition to the South American localities mentioned above, small diamonds have also been mined since their discovery in 1890 on the river Mazaruni in British Guiana, and finds have been reported in the gold washings of Dutch Guiana. Borneo has possessed a diamond industry since the island was first settled by the Malays; the references in the works of Garcia de Orta, Linschoten, De Boot, De Laet and others, to Malacca as a locality relate to Borneo. The large Borneo stone, over 360 carats in weight, known as the Matan, is in all probability not a diamond. The chief mines are situated on the river Kapnas in the west and near Bandjarmassin in the south-east of the island, and the alluvial deposits in which they occur are worked by a small number of Chinese and Malays. Australia has yielded diamonds in alluvial deposits near Bathurst (where the first discovery was made in 1851) and Mudgee in New South Wales, and also near Bingara and Inverell in the north of the colony. At Mount Werong a stone weighing 29 carats was found in 1905. At Ruby Hill near Bingara they were found in a breccia filling a volcanic pipe. At Ballina, in New England, diamonds have been found in the sea sand. Other Australian localities are Echunga in South Australia; Beechworth, Arena and Melbourne in Victoria; Fremantle and Nullagine in Western Australia; the Palmer and Gilbert rivers in Queensland. These have been for the most part discoveries in alluvial deposits of the gold-fields, and the stones were small. In Tasmania also diamonds have been found in the Corinna goldfields. Europe has produced few diamonds. Humboldt searched for them in the Urals on account of the similarity of the gold and platinum deposits to those of Brazil, and small diamonds were ultimately found (1829) in the gold washings of Bissersk, and later at Ekaterinburg and other spots in the Urals. In Lapland they have been found in the sands of the Pasevig river, Siberia has yielded isolated diamonds from the gold washings of Yenisei. In North America a few small stones have been found in alluvial deposits, mostly auriferous, in Georgia, N. and S. Carolina, Kentucky, Virginia, Tennessee, Wisconsin, California, Oregon and Indiana. A crystal weighing 23¾ carats was found in Virginia in 1855, and one of 21¼ carats in Wisconsin in 1886. In 1906 a number of small diamonds were discovered in an altered peridotite somewhat resembling the S. African blue ground, at Murfreesboro, Pike county, Arkansas. Considerable interest attaches to the diamonds found in Wisconsin, Michigan and Ohio near the Great Lakes, for they are here found in the terminal moraines of the great glacial sheet which is supposed to have spread southwards from the region of Hudson Bay; several of the drift minerals of the diamantiferous region of Indiana have been identified as probably of Canadian origin; no diamonds have however yet been found in the intervening country of Ontario. A rock similar to the blue ground of Kimberley has been found in the states of Kentucky and New York. The occurrence of diamond in meteorites is described below.

Origin of the Diamond in Nature.—It appears from the foregoing account that at most localities the diamond is found in alluvial deposits probably far from the place where it originated. The minerals associated with it do not afford much clue to the original conditions; they are mostly heavy minerals derived from the neighbouring rocks, in which the diamond itself has not been observed. Among the commonest associates of the diamond are quartz, topaz, tourmaline, rutile, zircon, magnetite, garnet, spinel and other minerals which are common accessory constituents of granite, gneiss and the crystalline schists. Gold (also platinum) is a not infrequent associate, but this may only mean that the sands in which the diamond is found have been searched because they were known to be auriferous; also that both gold and diamond are among the most durable of minerals and may have survived from ancient rocks of which other traces have been lost.

The localities at which the diamond has been supposed to occur in its original matrix are the following:—at Wajra Karur, in the Cuddapah district, India, M. Chaper found diamond with corundum in a decomposed red pegmatite vein in gneiss. At São João da Chapada, in Minas Geraes, diamonds occur in a clay interstratified with the itacolumite, and are accompanied by sharp crystals of rutile and haematite in the neighbourhood of decomposed quartz veins which intersect the itacolumite. It has been suggested that these three minerals were originally formed in the quartz veins. In both these occurrences the evidence is certainly not sufficient to establish the presence of an original matrix. At Inverell in New South Wales a diamond (1906) has been found embedded in a hornblende diabase which is described as a dyke intersecting the granite. Finally there is the remarkable occurrence in the blue ground of the African pipes.

There has been much controversy concerning the nature and origin of the blue ground itself; and even granted that (as is generally believed) the blue ground is a much serpentinized volcanic breccia consisting originally of an olivine-bronzite-biotite rock (the so-called kimberlite), it contains so many rounded and angular fragments of various rocks and minerals that it is difficult to say which of them may have belonged to the original rock, and whether any were formed *in situ*, or were brought up from below as inclusions. Carvill Lewis believed the blue ground to be true eruptive rock, and the carbon to have been derived from the bituminous shales of which it contains fragments. The Kimberley shales, which are penetrated by the De Beers group of pipes, were, however, certainly not the source of the carbon at the Premier (Transvaal) mine, for at this locality the shales do not exist. The view that the diamond may have crystallised out from solution in its present matrix receives some support from the experiments of W. Luzi, who found that it can be corroded by the solvent action of fused blue ground; from the experiments of J. Friedländer, who obtained diamond by dissolving graphite in fused olivine; and still more from the experiments of R. von Hasslinger and J. Wolff, who have obtained it by dissolving graphite in a fused mixture of silicates having approximately the composition of the blue ground. E. Cohen, who regarded the pipes as of the nature of a mud volcano, and the blue ground as a kimberlite breccia altered by hydrothermal action, thought that the diamond and accompanying minerals had been brought up from deep-seated crystalline schists. Other authors have sought the origin of the diamond in the action of the hydrated magnesian silicates on hydrocarbons derived from bituminous schists, or in the decomposition of metallic carbides.

Of great scientific interest in this connexion is the discovery of small diamonds in certain meteorites, both stones and irons; for example, in the stone which fell at Novo-Urei in Penza, Russia, in 1886, in a stone found at Carcote in Chile, and in the iron found at Cañon Diablo in Arizona. Graphitic carbon in cubic form (cliftonite) has also been found in certain meteoric "irons," for example in those from Magura in Szepes county, Hungary, and Youndegin near York in Western Australia. The latter is now generally believed to be altered diamond. The fact that H. Moissan has produced the diamond artificially, by allowing dissolved carbon to crystallize out at a high temperature and pressure from molten iron, coupled with the occurrence in meteoric iron, has led Sir William Crookes and others to conclude that the mineral may have been derived from deep-seated iron containing carbon in solution (see the article GEM, ARTIFICIAL). Adolf Knop suggested that this may have first yielded hydrocarbons by contact with water, and that from these the crystalline diamond has been formed. The meteoric occurrence has even suggested the fanciful notion that all diamonds were originally derived from meteorites. The meteoric iron of Arizona, some of which contains diamond, is actually found in and about a huge crater which is supposed by some to have been formed by an immense meteorite penetrating the earth's crust.

It is, at any rate, established that carbon can crystallize as diamond from solution in iron, and other metals; and it seems that high temperature and pressure and the absence of oxidizing agents are necessary conditions. The presence of sulphur, nickel, &c., in the iron appears to favour the production of the diamond. On the other hand, the occurrence in meteoric stones, and the experiments mentioned above, show that the diamond may also crystallize from a basic magma, capable of yielding some of the metallic oxides and ferro-magnesian silicates; a magma, therefore, which is not devoid of oxygen. This is still more forcibly suggested by the remarkable eclogite boulder found in the blue ground of the Newlands mine, not far from the Vaal river, and described by T. G. Bonney. The boulder is a crystalline rock consisting of pyroxene (chrome-diopside), garnet, and a little olivine, and is studded with diamond crystals; a portion of it is preserved in the British Museum (Natural History). In another eclogite boulder, diamond was found partly embedded in pyrope. Similar boulders have also been found in the blue ground elsewhere. Specimens of pyrope with attached or embedded diamond had previously been found in the blue ground of the De Beers mines. In the Newlands boulder the diamonds have the appearance of being an original constituent of the eclogite. It seems therefore that a holocrystalline pyroxene-garnet rock may be one source of the diamond found in blue ground. On the other hand many tons of the somewhat similar eclogite in the De Beers mine have been crushed and have not yielded diamond. Further, the ilmenite, which is the most characteristic associate of the diamond in blue ground, and other of the accompanying minerals, may have come from basic rocks of a different nature.

The Inverell occurrence may prove to be another example of diamond crystallized from a basic rock.

In both occurrences, however, there is still the possibility that the eclogite or the basalt is not the original matrix, but may have caught up the already formed diamond from some other matrix. Some regard the eclogite boulders as derived from deep-seated crystalline rocks, others as concretions in the blue ground.

None of the inclusions in the diamond gives any clue to its origin; diamond itself has been found as an inclusion, as have also black specks of some carbonaceous materials. Other black specks have been identified as haematite and ilmenite; gold has also been found; other included minerals recorded are rutile, topaz, quartz, pyrites, apophyllite, and green scales of chlorite (?). Some of these are of very doubtful identification; others (*e.g.* apophyllite and chlorite) may have been introduced along cracks. Some of the fibrous inclusions were identified by H. R. Göppert as vegetable structures and were supposed to point to an organic origin, but this view is no longer held. Liquid inclusions, some of which are certainly carbon dioxide, have also been observed.

Finally, then, both experiment and the natural occurrence in rocks and meteorites suggest that diamond may crystallize not only from iron but also from a basic silicate magma, possibly from various rocks consisting of basic silicates. The blue ground of S. Africa may be

the result of the serpentinization of several such rocks, and although now both brecciated and serpentinized some of these may have been the original matrix. A circumstance often mentioned in support of this view is the fact that the diamonds in one pipe generally differ somewhat in character from those of another, even though they be near neighbours.

History.—All the famous diamonds of antiquity must have been Indian stones. The first author who described the Indian mines at all fully was the Portuguese, Garcia de Orta (1565), who was physician to the viceroy of Goa. Before that time there were only legendary accounts like that of Sindbad's "Valley of the Diamonds," or the tale of the stones found in the brains of serpents. V. Ball thinks that the former legend originated in the Indian practice of sacrificing cattle to the evil spirits when a new mine is opened; birds of prey would naturally carry off the flesh, and might give rise to the tale of the eagles carrying diamonds adhering to the meat.

The following are some of the most famous diamonds of the world:—

A large stone found in the Golconda mines and said to have weighed 787 carats in the rough, before being cut by a Venetian lapidary, was seen in the treasury of Aurangzeb in 1665 by Tavernier, who estimated its weight after cutting as 280 (?) carats, and described it as a rounded rose-cut stone, tall on one side. The name *Great Mogul* has been frequently applied to this stone. Tavernier states that it was the famous stone given to Shah Jahan by the emir Jumla. The *Orloff*, stolen by a French soldier from the eye of an idol in a Brahmin temple, stolen again from him by a ship's captain, was bought by Prince Orloff for £90,000, and given to the empress Catharine II. It weighs 194⅞ carats, is of a somewhat yellow tinge, and is among the Russian crown jewels. The *Koh-i-nor*, which was in 1739 in the possession of Nadir Shah, the Persian conqueror, and in 1813 in that of the raja of Lahore, passed into the hands of the East India Company and was by them presented to Queen Victoria in 1850. It then weighed 186$\frac{1}{16}$ carats, but was recut in London by Amsterdam workmen, and now weighs 106$\frac{1}{16}$ carats. There has been much discussion concerning the possibility of this stone and the Orloff being both fragments of the Great Mogul. The Mogul Baber in his memoirs (1526) relates how in his conquest of India he captured at Agra the great stone weighing 8 mishkals, or 320 ratis, which may be equivalent to about 187 carats. The Koh-i-nor has been identified by some authors with this stone and by others with the stone seen by Tavernier. Tavernier, however, subsequently described and sketched the diamond which he saw as shaped like a bisected egg, quite different therefore from the Koh-i-nor. Nevil Story Maskelyne has shown reason for believing that the stone which Tavernier saw was really the Koh-i-nor and that it is identical with the great diamond of Baber; and that the 280 carats of Tavernier is a misinterpretation on his part of the Indian weights. He suggests that the other and larger diamond of antiquity which was given to Shah Jahan may be one which is now in the treasury of Teheran, and that this is the true Great Mogul which was confused by Tavernier with the one he saw. (See Ball, Appendix I. to Tavernier's *Travels* (1889); and Maskelyne, *Nature*, 1891, 44, p. 555.)

The *Regent* or *Pitt* diamond is a magnificent stone found in either India or Borneo: it weighed 410 carats and was bought for £20,400 by Pitt, the governor of Madras; it was subsequently, in 1717, bought for £80,000 (or, according to some authorities, £135,000) by the duke of Orleans, regent of France; it was reduced by cutting to 136$\frac{1}{16}$ carats; was stolen with the other crown jewels during the Revolution, but was recovered and is still in France. The *Akbar Shah* was originally a stone of 116 carats with Arabic inscriptions engraved upon it; after being cut down to 71 carats it was bought by the gaikwar of Baroda for £35,000. The *Nisam*, now in the possession of the nizam of Hyderabad, is supposed to weigh 277 carats; but it is only a portion of a stone which is said to have weighed 440 carats before it was broken. The *Great Table*, a rectangular stone seen by Tavernier in 1642 at Golconda, was found by him to weigh 242$\frac{3}{16}$ carats; Maskelyne regards it as identical with the *Darya-i-nur*, which is also a rectangular stone weighing about 186 carats in the possession of the shah of Persia. Another stone, the *Taj-e-mah*, belonging to the shah, is a pale rose pear-shaped stone and is said to weigh 146 carats.

Other famous Indian diamonds are the following:—the *Sancy*, weighing 53$\frac{1}{16}$ carats, which is said to have been successively the property of Charles the Bold, de Sancy, Queen Elizabeth, Henrietta Maria, Cardinal Mazarin, Louis XIV.; to have been stolen with the Pitt during the French Revolution; and subsequently to have been the property of the king of Spain, Prince Demidoff and an Indian prince. The *Nassak*, 78⅜ carats, the property of the duke of Westminster. The *Empress Eugénie*, 51 carats, the property of the gaikwar of Baroda. The *Pigott*, 49 carats (?), which cannot now be traced. The *Pasha*, 40 carats. The *White Saxon*, 48¾ carats. The *Star of Este*, 25$\frac{15}{16}$ carats.

Coloured Indian diamonds of large size are rare; the most famous are:—a beautiful blue brilliant, 67$\frac{5}{16}$ carats, cut from a stone weighing 112$\frac{5}{16}$ carats brought to Europe by Tavernier. It was stolen from the French crown jewels with the Regent and was never recovered. The *Hope*, 44½ carats, has the same colour and is probably a portion of the missing stone: it was so called as forming part of the collection of H. T. Hope (bought for £18,000), and was sold again in 1906 (resold 1909). Two other blue diamonds are known, weighing 13¾ and 1¾ carats, which may also be portions of the French diamond. The *Dresden Green*, one of the Saxon crown jewels, 40 carats, has a fine apple-green colour. The *Florentine*, 133½ carats, one of the Austrian crown jewels, is a very pale yellow.

The most famous Brazilian stones are:—The *Star of the South*, found in 1853, when it weighed 254½ carats and was sold for £40,000; when cut it weighed 125 carats and was bought by the gaikwar of Baroda for £80,000. Also a diamond belonging to Mr Dresden, 119 carats before, and 76½ carats after cutting.

Many large stones have been found in South Africa; some are yellow but some are as colourless as the best Indian or Brazilian stones. The most famous are the following:—the *Star of South Africa*, or *Dudley*, mentioned above, 83½ carats rough, 46½ carats cut. The *Stewart*, 288⅜ carats rough, 120 carats cut. Both these were found in the river diggings. The *Porter Rhodes* from Kimberley, of the finest water, weighed about 150 carats. The *Victoria*, 180 carats, was cut from an octahedron weighing 457½ carats, and was sold to the nizam of Hyderabad for £400,000. The *Tiffany*, a magnificent orange-yellow stone, weighs 125½ carats cut. A yellowish octahedron found at De Beers weighed 428½ carats, and yielded a brilliant of 288½ carats. Some of the finest and largest stones have come from the Jagersfontein mine; one, the *Jubilee*, found in 1895, weighed 640 carats in the rough and 239 carats when cut. Until 1905 the largest known diamond in the world was the *Excelsior*, found in 1893 at Jagersfontein by a native while loading a truck. It weighed 971 carats, and was ultimately cut into ten stones weighing from 68 to 13 carats. But all previous records were surpassed in 1905 by a magnificent stone more than three times the size of any known diamond, which was found in the yellow ground at the newly discovered Premier mine in the Transvaal. This extraordinary diamond weighed 3025¾ carats (1⅛ lb) and was clear and water white; the largest of its surfaces appeared to be a cleavage plane, so that it might be only a portion of a much larger stone. It was known as the *Cullinan Diamond*. This stone was purchased by the Transvaal government in 1907 and presented to King Edward VII. It was sent to Amsterdam to be cut, and in 1908 was divided into nine large stones and a number of small brilliants. The four largest stones weigh 516½ carats, 309$\frac{5}{16}$ carats, 92 carats and 62 carats respectively. Of these the first and second are the largest brilliants in existence. All the stones are flawless and of the finest quality.

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(H. A. Mi.)

DIAMOND NECKLACE, THE AFFAIR OF THE, a mysterious incident at the court of Louis XVI. of France, which involved the queen Marie Antoinette. The Parisian jewellers Boehmer and Bassenge had spent some years collecting stones for a necklace which they hoped to sell to Madame Du Barry, the favourite of Louis XV., and after his death to Marie Antoinette. In 1778 Louis XVI. proposed to the queen to make her a present of the necklace, which cost 1,600,000 livres. But the queen is said to have refused it, saying that the money would be better spent equipping a man-of-war. According to others, Louis XVI. himself changed his mind. After having vainly tried to place the necklace outside of France, the jewellers attempted again in 1781 to sell it to Marie Antoinette after the birth of the dauphin. It was again refused, but it was evident that the queen regretted not being able to acquire it.

At that time there was a personage at the court whom Marie Antoinette particularly detested. It was the cardinal Louis d Rohan, formerly ambassador at Vienna, whence he had been recalled in 1774, having incurred the queen's displeasure by revealing to the empress Maria Theresa the frivolous actions of her daughter, a disclosure which brought a maternal reprimand, and for having spoken lightly of Maria Theresa in a letter of which Marie Antoinette learned the contents. After his return to France the cardinal was anxious to regain the favour of the queen in order to obtain the position of prime minister. In March 1784 he entered into relations with a certain Jeanne de St Remy de Valois, a descendant of a bastard of Henry II., who after many adventures had married a *soi-disant* comte de Lamotte, and lived on a small pension which the king granted her. This adventuress soon gained the greatest ascendancy over the cardinal, with whom she had intimate relations. She persuaded him that she had been received by the queen and enjoyed her favour; and Rohan resolved to use her to regain the queen's good will. The comtesse de Lamotte assured the cardinal that she was making efforts on his behalf, and soon announced to him that he might send his justification to Marie Antoinette. This was the beginning of a pretended correspondence between Rohan and the queen, the adventuress duly returning replies to Rohan's notes, which she affirmed to come from the queen. The tone of the letters became very warm, and the cardinal, convinced that Marie Antoinette was in love with him, became ardently enamoured of her. He begged the countess to obtain a secret interview for him with the queen, and a meeting took place in August 1784 in a grove in the garden at Versailles between him and a lady whom the cardinal believed to be the queen herself. Rohan offered her a rose, and she promised him that she would forget the past. Later a certain Marie Lejay (renamed by the comtesse "Baronne Gay d'Oliva," the last word being apparently an anagram of Valoi), who resembled Marie Antoinette, stated that she had been engaged to play the role of queen in this comedy. In any case the countess profited by the cardinal's conviction to borrow from him sums of money destined ostensibly for the queen's works of charity. Enriched by these, the countess was able to take an honourable place in society, and many persons believed her relations with Marie Antoinette, of which she boasted openly and unreservedly, to be genuine. It is still an unsettled question whether she simply mystified people, or whether she was really employed by the queen for some unknown purpose, perhaps to ruin the cardinal. In any case the jewellers believed in the relations of the countess with the queen, and they resolved to use her to sell their necklace. She at first refused their commission, then accepted it. On the 21st of January 1785 she announced that the queen would buy the necklace, but that not wishing to treat directly, she left the affair to a high personage. A little while later Rohan came to negotiate the purchase of the famous necklace for the 1,600,000 livres, payable in instalments. He said that he was authorized by the queen, and showed the jewellers the conditions of the bargain approved in the handwriting of Marie Antoinette. The necklace was given up. Rohan took it to the countess's house, where a man, in whom Rohan believed he recognized a valet of the queen, came to fetch it. Madame de Lamotte had told the cardinal that Marie Antoinette would make him a sign to indicate her thanks, and Rohan believed that she did make him a sign. Whether it was so, or merely chance or illusion, no one knows. But it is certain that the cardinal, convinced that he was acting for the queen, had engaged the jewellers to thank her; that Boehmer and Bassenge, before the sale, in order to be doubly sure, had sent word to the queen of the negotiations in her name; that Marie Antoinette had allowed the bargain to be concluded, and that after she had received a letter of thanks from Boehmer, she had burned it. Meanwhile the "comte de Lamotte" appears to have started at once for London, it is said with the necklace, which he broke up in order to sell the stones.

When the time came to pay, the comtesse de Lamotte presented the cardinal's notes; but these were insufficient, and Boehmer complained to the queen, who told him that she had received no necklace and had never ordered it. She had the story of the negotiations repeated for her. Then followed a *coup de théâtre*. On the 15th of August 1785, Assumption day, when the whole court was awaiting the king and queen in order to go to the chapel, the cardinal de Rohan, who was preparing to officiate, was arrested and taken to the Bastille. He was able, however, to destroy the correspondence exchanged, as he thought, with the queen, and it is not known whether there was any connivance of the officials, who did not prevent this, or not. The comtesse de Lamotte was not arrested until the 18th of August, after having destroyed her papers. The police set to work to find all her accomplices, and arrested the girl Oliva and a certain Reteaux de Villette, a friend of the countess, who confessed that he had written the letters given to Rohan in the queen's name, and had imitated her signature on the conditions of the bargain. The famous charlatan Cagliostro was also arrested, but it was recognized that he had taken no part in the affair. The cardinal de Rohan accepted the parlement of Paris as judges. A sensational trial resulted (May 31, 1786) in the acquittal of the cardinal, of the girl Oliva and of Cagliostro. The comtesse de Lamotte was condemned to be whipped, branded and shut up in the Salpetrière. Her husband was condemned, in his absence, to the galleys for life. Villette was banished.

Public opinion was much excited by this trial. It is generally believed that Marie Antoinette was stainless in the matter, that Rohan was an innocent dupe, and that the Lamottes deceived both for their own ends. People, however, persisted in the belief that the queen had used the countess as an instrument to satisfy her hatred of the cardinal de Rohan. Various circumstances fortified this belief, which contributed to render Marie Antoinette very unpopular—her disappointment at Rohan's acquittal, the fact that he was deprived of his charges and exiled to the abbey of la Chaise-Dieu, and finally the escape of the comtesse de Lamotte from the Salpetrière, with the connivance, as people believed, of the court. The adventuress, having taken refuge abroad, published *Mémoires* in which she accused the queen. Her

husband also wrote *Mémoires*, and lived until 1831, after having, it is said, received subsidies from Louis XVIII.

See M. Tourneux, *Marie Antoinette devant l'histoire: Essai bibliographique* (2nd ed., Paris, 1901); Émile Campardon, *Marie Antoinette et le procès du collier* (Paris, 1863); P. Audebert, *L'Affaire du collier de la reine, d'après la correspondance inédite du chevalier de Pujol* (Rouen, 1901); F. d'Albini, *Marie Antoinette and the Diamond Necklace from another Point of View* (London, 1900); Funck-Brentano, *L'Affaire du collier* (1903); A. Lang, *Historical Mysteries* (1904). Carlyle's essay on *The Diamond Necklace* (first published in 1837 in *Fraser's Magazine*) is of historical literary interest.

DIANA, in Roman mythology, an old Italian goddess, in later times identified with the Greek Artemis (*q.v.*). That she was originally an independent Italian deity is shown by her name, which is the feminine form of Janus (= Dianus). She is essentially the goddess of the moon and light generally, and presides over wood, plain and water, the chase and war. As the goddess of childbirth, she was known, like Juno, by the name of Lucina, the "bringer to light." As the moon-goddess she was also identified with Hecate, and invoked as "three-formed" in reference to the phases of the moon. Her most celebrated shrine was in a grove at Aricia (whence her title of Nemorensis) near the modern lake of Nemi. Here she was worshipped side by side with a male deity Virbius, a god of the forest and the chase. This Virbius was subsequently identified with Hippolytus, the favourite of Artemis, who was said to have been brought to life by Aesculapius and conducted by Diana to Aricia (Ovid, *Fasti*, iii. 263, vi. 731, *Metam.* xv. 497; Virgil, *Aeneid*, vii. 761). A barbarous custom, perhaps reminiscent of human sacrifice once offered to her, prevailed in connexion with her ritual here; her priest, called *Rex Nemorensis*, who was a runaway slave, was obliged to qualify for office by slaying his predecessor in single combat (Strabo v. p. 239; Suetonius, *Caligula*, 35). This led to the identification of Diana with the Tauric Artemis, whose image was said to have been removed by Orestes to the grove of Aricia (see ARICINI).

After the destruction of Alba Longa this grove was for a long time the united sanctuary of the neighbouring Latin and Rutulian cities, until at last it was extinguished beneath the supremacy of Rome. The festival of the goddess was on the ides (13th) of August, the full moon of the hot season. She was worshipped with torches, her aid was sought by women seeking a happy deliverance in childbirth, and many votive offerings have been found on the site. The worship of Diana was brought to Rome by Latin plebeians, and hence she was regarded as the protectress of the lower classes, and especially of slaves. In accordance with this, her most important temple was that on the Aventine, the chief seat of the plebeians, founded by Servius Tullius, originally as a sanctuary of the Latin league (Dion. Halic. iv. 26). No man was allowed to enter the temple, and on the day of its dedication (August 13) the slaves kept holiday (Plutarch, *Quaest. Rom.* 100). This Diana was identified with the sister of Apollo, and at the secular games she was worshipped simply as Artemis. Another celebrated sanctuary of Diana was that on the slopes of Mount Tifata near Capua (where she was worshipped under the name of Tifatina), a sanctuary specially favoured by Sulla and Vespasian. As Noctiluca ("giving light by night") she had a sanctuary on the Palatine, which was kept illuminated throughout the night (Varro, *L.L.* v. 68). On the Nemi priesthood see J. G. Frazer, *Golden Bough*.

DIANA MONKEY, a West African representative of the guenon monkeys taking its name, *Cercopithecus diana*, from the presence of a white crescent on the forehead; another characteristic feature being the pointed white beard. The general colour of the fur is greyish, with a deep tinge of chestnut from the middle of the back to the root of the tail. Together with *C. neglectus* of East and Central Africa, *C. ignitus* of Liberia, and *C. roloway* of the Gold Coast, the diana represents the special subgenus of guenons known as *Pogonocebus*. Although the diana monkey is commonly seen in menageries, little is known of its habits in the wild state.

DIANE DE FRANCE (1538–1619), duchess of Montmorency and Angoulême, was the natural daughter of Henry II. of France and a young Piedmontese, Filippe Duc. The constable de Montmorency went so far as to assert that of all the children of Henry II. Diane was the only one who resembled him. Catherine de' Medici was greatly incensed at this affront, and took her revenge by having the constable disgraced on the death of Henry II. Brantôme is loud in praise of Diane. She was a perfect horsewoman and dancer, played several musical instruments, knew Spanish and Italian, and "estoit très belle de visage et de taille." Legitimated in 1547, she was married in 1553 to Horace Farnese, second son of the duke of Parma, but her husband was killed soon afterwards at the siege of Hesdin. In order to assure his position, the constable de Montmorency wished to marry her to his eldest son, Francis. This was a romantic adventure, for Francis had clandestinely married Mademoiselle de Piennes. The constable dissolved this union, and after lengthy negotiations obtained the dispensation of the pope. On the 3rd of May 1559 Francis married Diane. A wise and moderate woman, Diane undoubtedly helped to make Francis de Montmorency one of the leaders of the party of the *politiques*. Again a widow in 1579, she had some influence at the court of Henry III., and negotiated his reconciliation with Henry of Navarre (1588). She retained her influence in the reign of Henry IV., conveyed the bodies of Catherine de' Medici and Henry III. to St Denis, and died in 1519 at her hôtel of Angoulême.

See Brantôme, ed. by Lalanne, in the *Coll. de la société d'histoire de France*, vol. viii. (1875); J. de Thou, *Historia sui temporis* . . . (1733); Matthieu de Morgues, *Oraison funèbre de Diane de France* (Paris, 1619).

DIANE DE POITIERS (1499–1566), duchess of Valentinois, and mistress of Henry II. of France, was the daughter of Jean de Poitiers, seigneur de St Vallier, who came of an old family of Dauphiné. In 1515 she married Louis de Brézé, grand seneschal of Normandy, by whom she had two daughters. She became a widow in 1533, but soon replaced her husband by a more illustrious lover, the king's second son, Henry, who became dauphin in 1536. Although he was ten years younger than Diane, she inspired the young prince with a profound passion, which lasted until his death. The accession of Henry II. in 1547 was also the accession of Diane: she was virtual queen, while Henry's lawful wife, Catherine de' Medici, lived in comparative obscurity. The part Diane played, however, must not be exaggerated. More rapacious than ambitious, she concerned herself little with government, but devoted her energies chiefly to augmenting her income, and providing for her family and friends. Henry was the most prodigal of lovers, and gave her all rights over the duchy of Valentinois. Although she showed great tact in her dealings with the queen, Catherine drove her from the court after Henry's death, and forced her to restore the crown jewels and to accept Chaumont in exchange for Chenonceaux. Diane retired to her château at Anet, where she died in 1566.

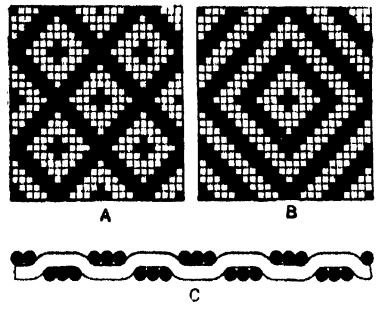
Several historians relate that she had been the mistress of Francis I. before she became the dauphin's mistress, and that she gave herself to the king in order to obtain the pardon of her father, who had been condemned to death as an accomplice of the constable de Bourbon. This rumour, however, has no serious foundation. Men vied with each other in celebrating Diane's beauty, which, if we may judge from her portraits, has been slightly exaggerated. She was a healthy, vigorous woman, and, by dint of great pains, succeeded in retaining her beauty late into life. It is said that even on the coldest mornings she would wash her face with well water. Diane was a patroness of the arts. She entrusted to Philibert de l'Orme the building of her château at Anet, and it was for her that Jean Goujon executed his masterpiece, the statue of Diana, now in the Louvre.

See G. Guiffrey, *Lettres inédites de Diane de Poytiers* (Paris, 1866) and *Procès criminel de Jehan de Poytiers* (Paris, 1867); Capefigue, *Diane de Poitiers* (Paris, 1860); Hay, *Madame Dianne de Poytiers* (London, 1900).

DIAPASON (Gr. διὰ πασῶν, through all), a term in music, originally for an interval of an octave. The Greek is an abbreviation of ἡ διὰ πασῶν χορδῶν συμφωνία, a consonance through all the tones of the scale. In this sense it is only used now, loosely, for the compass of an instrument or voice, or for a harmonious melody. The name is given to the two

foundation stops of an organ, the open and the stopped diapason (see ORGAN), and to a standard of musical pitch, as in the French *diapason normal* (see PITCH, MUSICAL).

DIAPER (derived through the Fr. from the Gr. *διά*, through, and *ἄσπρος*, white; the derivation from the town of Ypres, "d'Ypres," in Belgium is unhistorical, as diapers were known for centuries before its existence), the name given to a textile fabric, formerly of a rich and costly nature with embroidered ornament, but now of linen or cotton, with a simple woven pattern; and particularly restricted to small napkins. In architecture, the term "diaper" is given to any small pattern of a conventional nature repeated continuously and uniformly over a surface; the designs may be purely geometrical, or based



on floral forms, and in early examples were regulated by the process of their textile origin. Subsequently, similar patterns were employed in the middle ages for the surface decoration of stone, as in Westminster Abbey and Bayeux cathedral in the spandrils of the arcades of the choir and nave; also in mural painting, stained glass, incised brasses, encaustic tiles, &c. Probably in most cases the pattern was copied, so far as the general design is concerned, from the tissues and stuffs of Byzantine manufacture, which came over to Europe and were highly prized as ecclesiastical vestments.

In its textile use, the term diaper was originally applied to silk patterns of a geometrical pattern; it is now almost exclusively used for diamond patterns made from linen or cotton yarns. An illustration of two patterns of this nature is shown in the figure. The floats of the warp and the weft are mostly in three; indeed the patterns are made from a base weave which is composed entirely of floats of this number. It will be seen that both designs are formed of what may be termed concentric figures—alternately black and white. Pattern B differs from pattern A only in that more of these concentric figures are used for the complete figure. If pattern B, which shows only one unit, were extended, the effect would be similar to A, except for the size of the unit. In A there are four complete units, and hence the pattern appears more striking. Again, the repeating of B would cause the four corner pieces to join and to form a diamond similar to the one in the centre. The two diamonds in B would then alternate diagonally to left and right. Special names are given to certain kinds of diapers, *e.g.* "bird's-eye," "pheasant's-eye"; these terms indicate, to a certain extent, the size of the complete diamond in the cloth—the smaller kind taking the name "bird's-eye." The size of the pattern on paper has little connexion with the size of the pattern in the cloth, for it is clearly the number of threads and picks per inch which determine the size of the pattern in the cloth from any given design. Although A is larger than what is usually termed the "bird's-eye" pattern, it is evident that it may be made to appear as such, provided that the cloth is fine enough. These designs, although adapted mostly for cloths such as nursery-diapers, for pinafores, &c., are sometimes used in the production of towels and table-cloths. In the figure, the first pick in A is identical with the first pick in B, and the part C shows how each interweaves with the twenty-four threads.

DIAPHORETICS (from Gr. *διαφορεῖν*, to carry through), the name given to those remedies which promote perspiration. In health there is constantly taking place an exhalation of watery vapour from the skin, by which not only are many of the effete products of nutrition eliminated, but the body is kept cool. Under exertion or in a heated atmosphere this natural function of the skin is increased, sweating more or less profuse follows, and, evaporation going on rapidly over the whole surface, little or no rise in the temperature of the body takes place. In many forms of disease, such as fevers and inflammatory affections, the action of the skin is arrested, and the surface of the body feels harsh and dry, while the temperature is greatly elevated. The occurrence of perspiration not unfrequently marks a crisis in such diseases, and is in general regarded as a favourable event. In some chronic diseases, such as diabetes and some cases of Bright's disease, the absence of perspiration is a marked feature; while, on the other hand, in many wasting diseases, such as phthisis, the action of the skin is increased, and copious exhausting sweating occurs. Many means can be used to induce perspiration, among the best known being baths, either in the form of hot vapour or hot water baths, or in that part of the process of the Turkish bath which consists in exposing the body to a dry and hot atmosphere. Such measures, particularly if followed by the drinking of hot liquids and the wrapping of the body in warm clothing, seldom fail to excite copious perspiration. Numerous medicinal substances have a similar effect.

DIAPHRAGM (Gr. *διάφραγμα*, a partition). The diaphragm or midriff (Anglo-Saxon, *mid*, middle, *hrif*, belly) in human anatomy is a large fibro-muscular partition between the cavities of the thorax and abdomen; it is convex toward the thorax, concave toward the abdomen, and consists of a central tendon and a muscular margin. The *central tendon* (*q*, fig. 1) is trefoil in shape, its leaflets being right, left and anterior; of these the right is the largest and the left the smallest. The fleshy fibres rise, in front from the back of the xiphoid cartilage of the sternum (*d*), laterally by six serrations, from the inner surfaces of the lower six ribs, interdigitating with the transversalis, posteriorly from the arcuate ligaments, of which there are five, a pair of external, a pair of internal, and a single median one. The *external arcuate ligament* (*h*) stretches from the tip of the twelfth rib (*b*) to the costal process of the first lumbar vertebra in front of the quadratus lumborum muscle (*o*), the *internal* and *middle* are continuations of the *crura* which rise from the ventro-lateral aspects of the bodies of the lumbar vertebrae, the right (*e*) coming from three, the left (*f*) from two. On reaching the level of the twelfth thoracic vertebra each crus spreads out into a fan-shaped mass of fibres, of which the innermost join their fellows from the opposite crus, in front of the aortic opening (*k*), to form the *middle arcuate*

FIG. 1.—Abdominal Surface of the Diaphragm.

ligament; the outer ones (*g*) arch in front of the psoas muscle (*n*) to the tip of the costal process of the first lumbar vertebra to form the *internal arcuate ligament*, while the intermediate ones pass to the central tendon. There are three large openings in the diaphragm; the *aortic* (*k*) is behind the middle arcuate ligament and transmits the aorta, the vena azygos major, and the thoracic duct. In the right leaflet is an opening (sometimes called the *hiatus quadratus*) for the inferior vena cava and a branch of the right phrenic nerve (*m*), while in front and a little to the left of the aortic opening is one for the oesophagus and the two pneumogastric nerves (*l*), the left being in front and the right behind.

The fleshy fibres on each side of this opening act as a sphincter. Passing between the xiphoid and costal origins in front are the superior epigastric arteries, while the other terminal branches of the internal mammaries, the musculo-phrenics, pass through between two costal origins.

Through the crura pass the splanchnic nerves, and in addition to these the left crus is pierced by the vena azygos minor. The sympathetic nerves usually enter the abdomen behind the internal arcuate ligaments. The phrenic nerves, which are the main supply of the diaphragm, divide before reaching the muscle and pierce it in a number of places to enter its abdominal surface, but some of the lower intercostal nerves assist in the supply. The last thoracic or subcostal nerves pass behind the external arcuate ligament.

For the action of the diaphragm see RESPIRATORY SYSTEM.

Embryology.—The diaphragm is at first developed in the neck region of the embryo, and this accounts for the phrenic nerves, which supply it, rising from the fourth and fifth cervical. From the mesoderm on the caudal side of the pericardium is developed the *septum transversum*, and in this the central tendon is formed. The fleshy portion is developed on each side in two parts, an anterior or sterno-costal which is derived from the longitudinal neck musculature, probably the same layer from which the sternothyroid comes, and a spinal part which is a derivative of the transversalis sheet of the trunk. Between these two parts is at one time a gap, the *spino-costal hiatus*, and this is obliterated by the growth of the pleuro-peritoneal membrane, which may occasionally fail to close and so may form the site of a phrenic hernia. With the growth of the body and the development of the lungs the diaphragm shifts its position until it becomes the septum between the thoracic and abdominal cavities. (See A. Keith, "On the Development of the Diaphragm," *Jour. of Anat. and Phys.* vol. 39.) A. Paterson has recorded cases in which the left half of the diaphragm is wanting (*Proceedings* of the Anatomical Society of Gt. Britain, June 1900; *Jour. of Anat. and Phys.* vol. 34), and occasionally deficiencies are found elsewhere, especially in the sternal portion. For further details see Quain's *Anatomy*, vol. i. (London, 1908).

Comparative Anatomy.—A complete diaphragm, separating the thoracic from the abdominal parts of the coelom, is characteristic of the Mammalia; it usually has the human structure and relations except that below the Anthropoids it is separated from the pericardium by the azygous lobe of the lung. In some Mammals, *e.g.* Echidna and Phocoena, it is entirely muscular. In the Cetacea it is remarkable for its obliquity; its vertebral attachment is much nearer the tail than its sternal or ventral one; this allows a much larger lung space in the dorsal than in the ventral part of the thorax, and may be concerned with the equipoise of the animal. (Otto Müller, "Untersuchungen über die Veränderung, welche die Respirationsorgane der Säugetiere durch die Anpassung an das Leben im Wasser erlitten haben," *Jen. Zeitschr. f. Naturwiss.*, 1898, p. 93.) In the Ungulata only one crus is found (Windle and Parsons, "Muscles of the Ungulata," *Proc. Zool. Soc.*, 1903, p. 287). Below the Mammals incomplete partitions between the pleural and peritoneal cavities are found in Chelonians, Crocodiles and Birds, and also in Amphibians (Xenopus and Pipa). (F. G. P.)

DIARBEKR[1] (*Kara Amid* or Black Amid; the Roman *Amida*), the chief town of a vilayet of Asiatic Turkey, situated on a basaltic plateau on the right bank of the Tigris, which here flows in a deep open valley. The town is still surrounded by the masonry walls of black basalt which give it the name of *Kara* or Black Amid; they are well built and imposing on the west facing the open country, but almost in ruins where they overlook the river. A mass of gardens and orchards cover the slope down to the river on the S.W., but there are no suburbs outside the walls. The houses are rather crowded but only partially fill the walled area. The population numbers 38,000, nearly half being Christian, comprising Turks, Kurds, Arabs, Turkomans, Armenians, Chaldeans, Jacobites and a few Greeks. The streets are 10 ft. to 15 ft. wide, badly paved and dirty; the houses and shops are low, mostly of stone, and some of stone and mud. The bazaar is a good one, and gold and silver filigree work is made, peculiar in character and design. The cotton industry is declining, but manufacture of silk is increasing. Fruit is good and abundant as the rich volcanic soil is well watered from the town springs. The size of the melons is specially famous. To the south, the walls are some 40 ft. high, faced with large cut stone blocks of very solid construction, with towers and square bastions rising to 50 ft. There are four gates: on the north the Kharput gate, on the west the Rum, on the south the Mardin, and on the east the Yeni Kapu or new gate. A citadel enclosure stands at the N.E. corner and is now partly in ruins, but the interior space is occupied by the government konak. The summer climate in the confined space within the town is excessively hot and unhealthy. Epidemics of typhus are not unknown, as well as ophthalmia. The Diarbekr boil is like the "Aleppo button," lasting a long time and leaving a deep scar. Winters are frequently severe but do not last long. Snow sometimes lies, and ice is stored for summer use. Scorpions noted for the virulence of their poison abound as well as horse leeches in the tanks. The town is supplied with water both by springs inside the town and by aqueducts from fountains at Ali Punar and Hamervat. The principal exports are wool, mohair and copper ore, and imports are cotton and woollen goods, indigo, coffee, sugar, petroleum, &c.

The Great Mosque, Ulu Jami, formerly a Christian church, occupies the site of a Sassanian palace and was built with materials from an older palace, probably that of Tigranes II. The remains consist of the façades of two palaces 400 ft. apart, each formed by a row of Corinthian columns surmounted by an equal number of a Byzantine type. Kufic inscriptions run across the fronts under the entablature. The court of the mosque is entered by a gateway on which lions and other animals are sculptured. The churches of greatest interest are those of SS. Cosmas and Damian (Jacobite) and the church of St James (Greek). In the 19th century Diarbekr was one of the largest and most flourishing cities of Asia, and as a commercial centre it now stands at the meeting-point of several important routes. It is at the head of the navigation of the Tigris, which is traversed down stream by *keleks* or rafts supported by inflated skins. There is a good road to Aleppo and Alexandretta on the Mediterranean, and to Samsun on the Black Sea by Kharput, Malatia and Sivas. There are also routes to Mosul and Bitlis.

Diarbekr became a Roman colony in A.D. 230 under the name of Amida, and received a Christian bishop in A.D. 325. It was enlarged and strengthened by Constantius II., in whose reign it was taken after a long siege by Shapur (Sapor) II., king of Persia. The historian Ammianus Marcellinus, who took part in the defence, gives a detailed account of it. In the later wars between the Persians and Romans it more than once changed hands. Though ceded by Jovian to the Persians it again became annexed to the Roman empire, and in the reign of Anastasius (A.D. 502) was once more taken by the Persians, when 80,000 of its inhabitants were slain. It was taken *c.* 638 by the Arabs, and afterwards passed into the hands of the Seljuks and Persians, from whom it was finally captured by Selim I. in 1515; and since that date it has remained under Ottoman rule. About 2 m. below the town is a masonry bridge over the Tigris; the older portion being probably Roman, and the western part, which bears a Kufic inscription, being Arab.

The vilayet of Diarbekr extends south from Palu on the Euphrates to Mardin and Nisibin on the edge of the Mesopotamian plain, and is divided into three sanjaks—Arghana, Diarbekr and Mardin. The headwaters of the main arm of the Tigris have their source in the vilayet.

Cereals, cotton, tobacco, rice and silk are produced, but most of the fertile lands have been abandoned to semi-nomads, who raise large quantities of live stock. The richest portion of the vilayet lies east of the capital in the rolling plains watered by tributaries of the Tigris. An exceptionally rich copper mine exists at Arghana Maden, but it is very imperfectly worked; galena mineral oil and silicious sand are also found.

(C. W. W.; F. R. M.)

DIARRHOEA (from Gr. διά, through, ῥέω, flow), an excessive looseness of the bowels, a symptom of irritation which may be due to various causes, or may be associated with some specific disease. The treatment in such latter cases necessarily varies, since the symptom itself may be remedial, but in ordinary cases depends on the removal of the cause of irritation by the use of aperients, various sedatives being also prescribed. In chronic diarrhoea careful attention to the diet is necessary.

[1] From *Diar*, land, and Bekr (*i.e.* Abu Bekr, the caliph).

DIARY, the Lat. *diarium* (from *dies*, a day), the book in which are preserved the daily memoranda regarding events and actions which come under the writer's personal observation, or are related to him by others. The person who keeps this record is called a diarist. It is not necessary that the entries in a diary should be made each day, since every life, however full, must contain absolutely empty intervals. But it is essential that the entry should be made during the course of the day to which it refers. When this has evidently not been done, as in the case of Evelyn's diary, there is nevertheless an effort made to give the memoranda the effect of being so recorded, and in point of fact, even in a case like that of Evelyn, it is probable that what we now read is an enlargement of brief notes jotted down on the day cited. When this is not approximately the case, the diary is a fraud, for its whole value depends on its instantaneous transcript of impressions.

In its primitive form, the diary must always have existed; as soon as writing was invented, men and women must have wished to note down, in some almanac or journal, memoranda respecting their business, their engagements or their adventures. But the literary value of these would be extremely insignificant until the spirit of individualism had crept in, and human beings began to be interesting to other human beings for their own sake. It is not, therefore, until the close of the Renaissance that we find diaries beginning to have literary value, although, as the study of sociology extends, every scrap of genuine and unaffected record of early history possesses an ethical interest. In the 17th century, diaries began to be largely written in England, although in most cases without any idea of even eventual publication. Sir William Dugdale (1605–1686) had certainly no expectation that his slight diary would ever see the light. There is no surviving record of a journal kept by Clarendon, Richard Baxter, Lucy Hutchinson and other autobiographical writers of the middle of the century, but we may take it for granted that they possessed some such record, kept from day to day. Bulstrode Whitelocke (1605–1675), whose *Memorials of the English Affairs* covers the ground from 1625 to 1660, was a genuine diarist. So was the elder George Fox (1624–1690), who kept not merely "a great journal," but "the little journal books," and whose work was published in 1694. The famous diary of John Evelyn (1620–1706) professes to be the record of seventy years, and, although large tracts of it are covered in a very perfunctory manner, while in others many of the entries have the air of having been written in long after the event, this is a very interesting and amusing work; it was not published until 1818. In spite of all its imperfections there is a great charm about the diary of Evelyn, and it would hold a still higher position in the history of literature than it does if it were not overshadowed by what is unquestionably the most illustrious of the diaries of the world, that of Samuel Pepys (1633–1703). This was begun on the 1st of January 1660 and was carried on until the 29th of May 1669. The extraordinary value of Pepys' diary consists in its fidelity to the portraiture of its author's character. He feigns nothing, conceals nothing, sets nothing down in malice or insincerity. He wrote in a form of shorthand intelligible to no one but himself, and not a phrase betrays the smallest expectation that any eye but his own would ever investigate the pages of his confession. The importance of this wonderful document, in fact, lay unsuspected until 1819, when the Rev. John Smith of Baldock began to decipher the MS. in Magdalene College, Cambridge. It was not until 1825 that Lord Braybrooke published part of what was only fully edited, under the care of Mr Wheatley, in 1893–1896. In the age which succeeded that of Pepys, a diary of extraordinary emotional interest was kept by Swift from 1710 to 1713, and was sent to Ireland in the form of a "Journal to Stella"; it is a surprising amalgam of ambition, affection, wit and freakishness. John Byrom (1692–1763), the Manchester poet, kept a journal, which was published in 1854. The diary of the celebrated dissenting divine, Philip Doddridge (1702–1751), was printed in 1829. Of far greater interest are the admirably composed and vigorously written journals of John Wesley (1703–1791). But the most celebrated work of this kind produced in the latter half of the 18th century was the diary of Fanny Burney (Madame D'Arblay), published in 1842–1846. It will be perceived that, without exception, these works were posthumously published, and the whole conception of the diary has been that it should be written for the writer alone, or, if for the public, for the public when all prejudice shall have passed away and all passion cooled down. Thus, and thus only, can the diary be written so as to impress upon its eventual readers a sense of its author's perfect sincerity and courage.

Many of the diaries described above were first published in the opening years of the 19th century, and it is unquestionable that the interest which they awakened in the public led to their imitation. Diaries ceased to be rare, but as a rule the specimens which have hitherto appeared have not presented much literary interest. Exception must be made in favour of the journals of two minor politicians, Charles Greville (1794–1865) and Thomas Creevey (1768–1838), whose indiscretions have added much to the gaiety of nations; the papers of the former appeared in 1874–1887, those of the latter in 1903. The diary of Henry Crabb Robinson (1775–1867), printed in 1869, contains excellent biographical material. Tom Moore's journal, published in 1856 by Lord John Russell, disappointed its readers. But it is probable, if we reason by the analogy of the past, that the most curious and original diaries of the 19th century are still unknown to us, and lie jealously guarded under lock and key by the descendants of those who compiled them.

It was natural that the form of the diary should appeal to a people so sensitive to social peculiarities and so keen in the observation of them as the French. A medieval document of immense value is the diary kept by an anonymous *curé* during the reigns of Charles VI. and Charles VII. This *Journal d'un bourgeois de Paris* was kept from 1409 to 1431, and was continued by another hand down to 1449. The marquis de Dangeau (1638–1720) kept a diary from 1684 till the year of his death; this although dull, and as Saint-Simon said "of an insipidity to make you sick," is an inexhaustible storehouse of facts about the reign of Louis XIV. Saint-Simon's own brilliant memoirs, written from 1691 to 1723, may be considered as a sort of diary. The lawyer, Edmond Barbier (1689–1771), wrote a journal of the anecdotes and little facts which came to his knowledge from 1718 to 1762. The studious care which he took to be correct, and his manifest candour, give a singular value to Barbier's record; his diary was not printed at all until 1847, nor, in its entirety, until 1857. The song-writer, Charles Collé (1709–1783), kept a *journal historique* from 1758 to 1782; it is full of vivacity, but very scandalous and spiteful. It saw the light in 1805, and surprised those to whom Collé, in his lifetime, had seemed the most placid and good-natured of men. Petit de Bachaumont (1690–1770) had access to remarkable sources of information, and his *Mémoires secrets* (a diary the publication of which began in 1762 and was continued after Bachaumont's death, until 1787, by other persons) contains a valuable mass of documents. The marquis d'Argenson (1694–1757) kept a diary, of which a comparatively full text was first published in 1859. In recent times the posthumous publication of the diaries of the Russian artist, Marie Bashkirtseff (1860–1884), produced a great sensation in 1887, and revealed a most remarkable temperament. The brothers Jules and Edmond de Goncourt kept a very minute diary of all that occurred around them in artistic and literary Paris; after the death of Jules, in 1870, this was continued by Edmond, who published the three first volumes in 1888. The publication of this work was continued, and it produced no little scandal. It is excessively ill-natured in parts, but of its vivid picturesqueness, and of its general accuracy as a transcript of conversation, there can be no two opinions.

(E. G.)

DIASPORE, a native aluminium hydroxide, AlO(OH), crystallizing in the orthorhombic system and isomorphous with göthite and manganite. It occurs sometimes as flattened crystals, but usually as lamellar or scaly masses, the flattened surface being a direction of perfect cleavage on which the lustre is markedly pearly in character. It is colourless or greyish-white, yellowish, sometimes violet in colour, and varies from translucent to

transparent. It may be readily distinguished from other colourless transparent minerals, with a perfect cleavage and pearly lustre—mica, talc, brucite, gypsum—by its greater hardness of 6½-7. The specific gravity is 3·4. When heated before the blowpipe it decrepitates violently, breaking up into white pearly scales; it was because of this property that the mineral was named diaspore by R. J. Haüy in 1801, from διασπείρειν, "to scatter." The mineral occurs as an alteration product of corundum or emery, and is found in granular limestone and other crystalline rocks. Well-developed crystals are found in the emery deposits of the Urals and at Chester, Massachusetts, and in kaolin at Schemnitz in Hungary. If obtainable in large quantity it would be of economic importance as a source of alumina. (L. J. S.)

DIASTYLE (from Gr. διά, through, and στῦλος, column), in architecture, a term used to designate an intercolumniation of three or four diameters.

DIATOMACEAE. For the knowledge we possess of these beautiful plants, so minute as to be undiscernible by our unaided vision, we are indebted to the assistance of the microscope. It was not till towards the close of the 18th century that the first known forms of this group were discovered by O. F. Müller. And so slow was the process of discovery in this field of scientific research that in the course of half a century, when Agardh published his *Systema algarum* in 1824, only forty-nine species included under eight genera had been described. Since that time, however, with modern microscopes and microscopic methods, eminent botanists in all parts of the civilized world have studied these minute plants, with the result that the number of known genera and species has been greatly increased. Over 10,000 species of diatoms have been described, and about 1200 species and numerous varieties occur in the fresh waters and on the coasts of Great Britain and Ireland. Rabenhorst, in the index to his *Flora Europaea algarum* (1864) enumerated about 4000 forms which had up to that time been discovered throughout the continent of Europe.

The diatoms are more commonly known among systematic botanists as the Bacillarieae, particularly on the continent of Europe, and although such an immense number of very diverse forms are included in it, the group as a whole exhibits a remarkable uniformity of structure. The Bacillarieae is one of the large groups of Algae, placed by some in close proximity to the

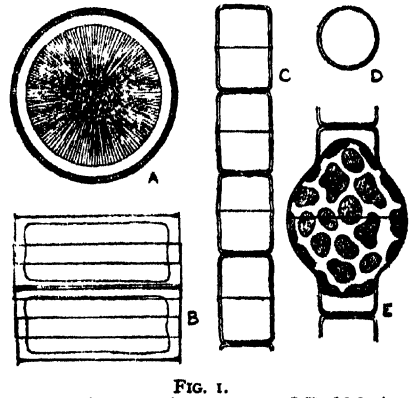


FIG. 1.
A and B, *Melosira arenaria*. C-E, *Melosira varians*.
E, showing formation of auxospore. All ×450.

Conjugatae and by others as an order of the Brown Algae (or Phaeophyceae); but their characters are so distinctive and their structure is so uniform as to warrant the separation of the diatoms as a distinct class. The affinities of the group are doubtful.

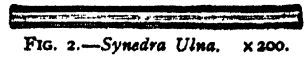


FIG. 2.—*Synedra Ulna*. ×200.

The diatoms exhibit great variety of form. While some species are circular and more or less disk-shaped, others are oval in outline. Some are linear, as *Synedra Ulna* (fig. 2); others more or less crescentic; others again are cuneate, as *Podosphenia Lyngbyii* (fig. 3); some few have a sigmoid outline, as *Pleurosigma balticum* (fig. 4); but the prevailing forms are naviculoid, as in the large family Naviculaceae, of which the genus *Navicula* embraces upwards of 1000 species. They vary also in their modes of growth,—some being free-floating, others attached to foreign bodies by simple or branched gelatinous stalks, which in some species are short and thick, while in others they are long and slender. In some genera the forms are simple, while in others the frustules are connected together in ribbon-like filaments, or form, as in other cases, zigzag chains. In some genera the individuals are naked, while in many others they are enclosed in a more or less definite gelatinous investment. The conditions necessary to their growth are moisture and light. Wherever these circumstances coexist, diatomaceous forms will almost invariably be found. They occur mixed with other organisms on the surface of moist rocks; in streamlets and pools, they form a brownish stratum on the surface of the mud, or cover the stems and leaves of water plants or floating twigs with a furry investment. Marine forms are usually attached to various sea-weeds, and many are found in the stomachs of molluscs, holothurians, ascidians and other denizens of the ocean. The fresh-water forms are specifically distinct from those incidental to salt or brackish water,—fresh-water species, however, are sometimes

FIG. 3.—*Podosphenia Lyngbyii*. ×400.

FIG. 4.—*Pleurosigma balticum*. ×200.

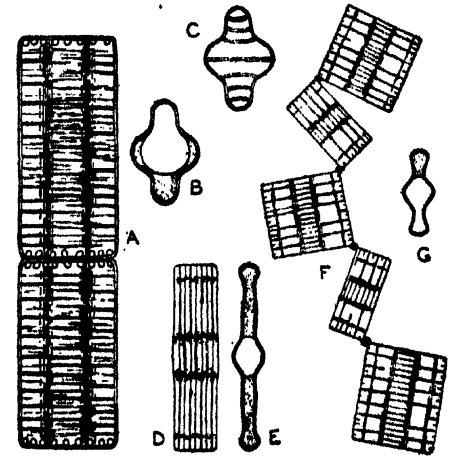


FIG. 5.
A-C, *Tetracyclus lacustris*. D and E, *Tabellaria fenestrata*.
F and G, *Tabellaria flocculosa*. All ×500.

carried some distance into the sea by the force of the current, and in tidal rivers marine forms are carried up by the force of the tide. Some notion may be formed of the extreme minuteness of these forms from the fact that one the length of which is $\frac{1}{100}$th of an inch may be considered as beyond the medium size. Some few, indeed, are much larger, but by far the greater proportion are of very much smaller dimensions.

Diatoms are unicellular plants distinguished from kindred forms by the fact of having their soft vegetative part covered by a siliceous case. Each individual is known as a frustule, and the cell-wall consists of two similar valves nearly parallel to each other, each valve being furnished with a rim (or connecting-band) projecting from it at a right angle.

One of these valves with its rim is slightly smaller than the